Second HALO Workshop
Infrastructure Candidate Solutions

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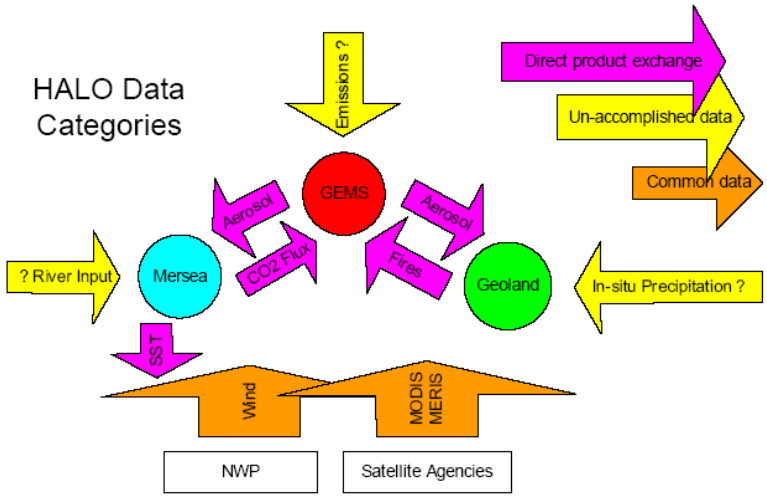
WP 3210/ 3310

Harmonised coordination of the Atmosphere, Land and Ocean integrated projects of the GMES backbone

HALO Objectives

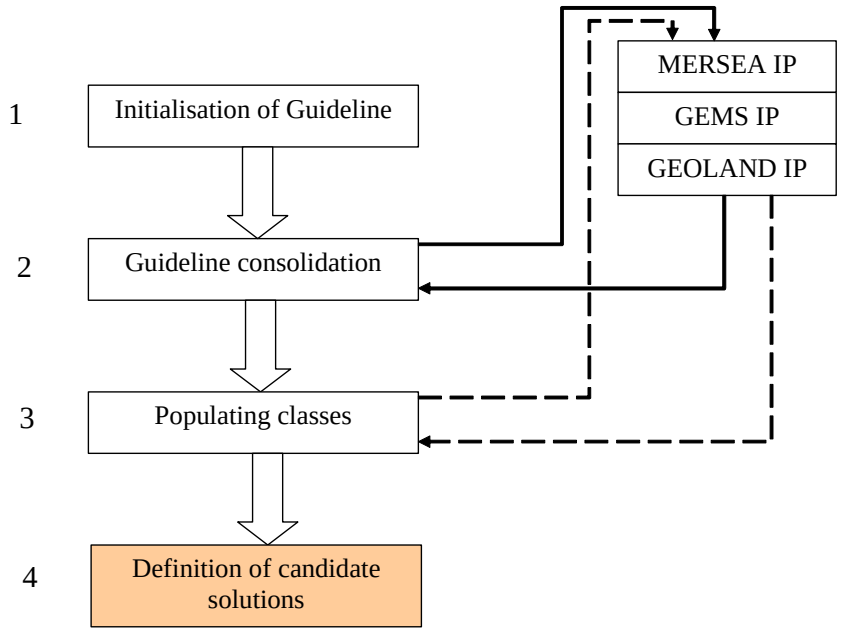
Nota: The design considerations of the HALO project are based partly on the current versions of the systems and in the perspective of their final operational version. It is in that sense that references to the **IP** must be understood.

HALO wants to support the transition of the IPs to **operational** system status. Indeed, operational commitment imposes time constrains of the data production, transfer and *storage*. **Common data** needs or product **exchanges** are a strong link between the systems and a **shared solution** could be beneficial for all.



STUDY LOGIC

WP 3210/3310 aims at defining candidate solutions for both common data needs provision and products exchanges interface between systems.



KEY INFRASTRUCTURE ISSUES (1/2)

1. End-to-end service provision

   The targeted infrastructure shall enable the provision of services in a end-to-end perspective. This implies ensuring optimal "**communication**" between the main infrastructure elements.

   The **harmonisation & interoperability** of data and services are key issues for HALO.

2. Distributed versus centralized architecture

   The overall GMES service is envisaged as a *network of distributed services facilities*. The infrastructure is to be built in networking service providers at European, national or regional level.

   The proposed infrastructure should well balance what facilities should be **distributed** and what functions should be **centralised**.

3. Facilitate information exchange, sharing and dissemination

   Production of "integrated" information generally imply to merge, to aggregate or to combine different types of data sets, coming from different sources.

   The proposed infrastructure should therefore supply effective access to the input data, including data sets produced by other services (**interacting**).

KEY INFRASTRUCTURE ISSUES (2/2)

4. Enable multi-level service access

   The service access shall be multi-level: European, national or regional. The way to structure, to network and to hierarchy the available information enables to work at different scales in a consistent manner, and should facilitate exchanges of information between different areas.

5. Relevant standards and protocols to ensure interoperability

   The infrastructure will be built on a network of service facilities, this implies to set-up full **interoperability** between services facilities in order to establish communication and share data. In coherence with the INSPIRE, OGC…approach, actions of standardisation, harmonisation and integration of data and services are required during the infrastructure design.

6. Synergy with other initiatives

   HALO shall take benefit from and provide material to ongoing close related initiatives (ORCHESTRA, OASIS, WIN, INSPIRE,….).

KEY INFRASTRUCTURE ISSUES *Synthesis*

- The "**User perspective**" :
  - ✓ Unified access to data and services
  - ✓ Access to integrated information
- The "**Service perspective**" :
  - ✓ Data harmonization
  - ✓ Service interoperability
  - ✓ Service discovery through a unified access
- The "**System design perspective**" :
  - Handling of heterogeneous data (EO and non-EO data, models)
  - Data and service standardization
  - System flexibility, scalability
  - Link to close related initiatives
  - Access to distributed facilities through centralized functions

INFRASTRUCTURE MODEL (1/3)

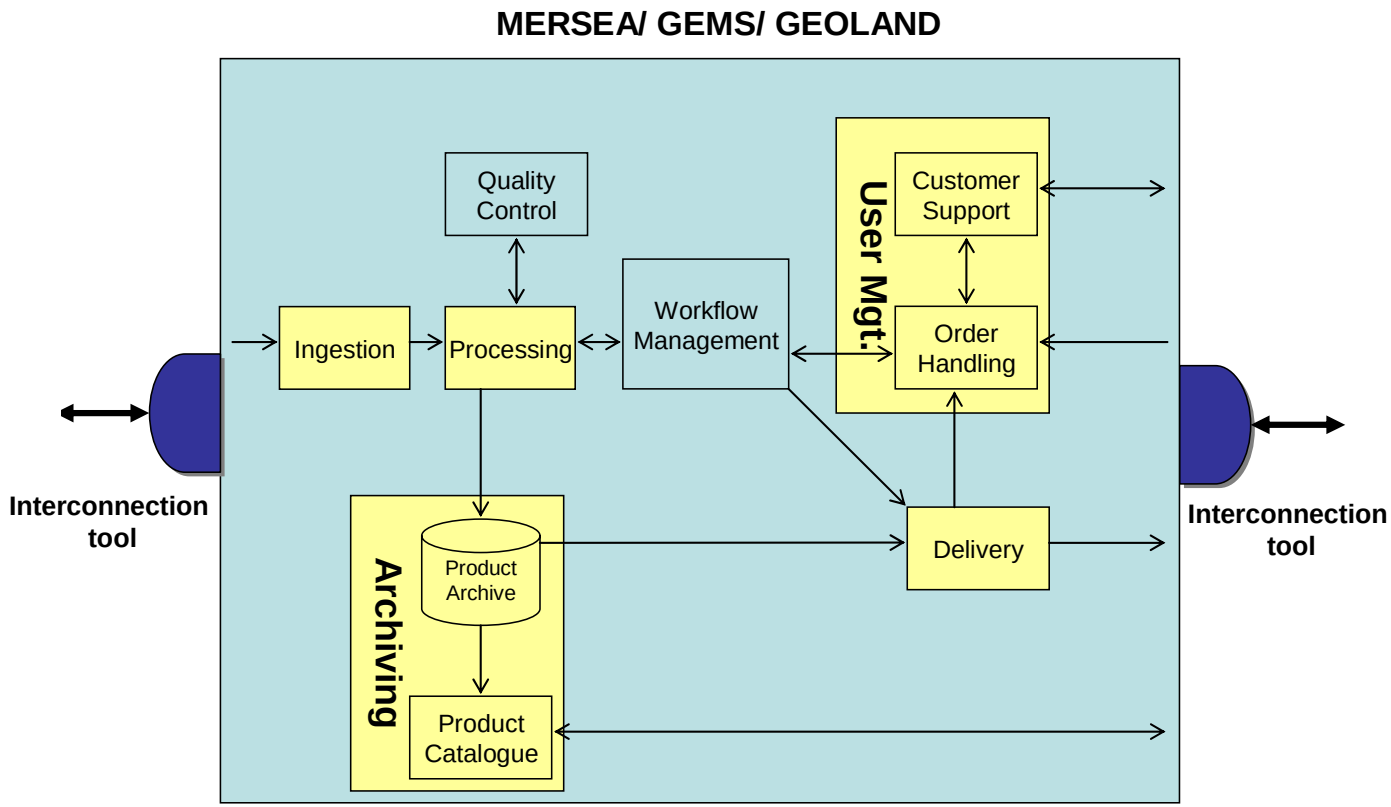
To achieve the infrastructure requirements, HALO envisages to design the infrastructure by a model-based approach.

The rationale is to propose a conceptual framework which defines generic components (The model does not imply any constraints on the implementation choices, a component can be deployed through multiple different implementations).

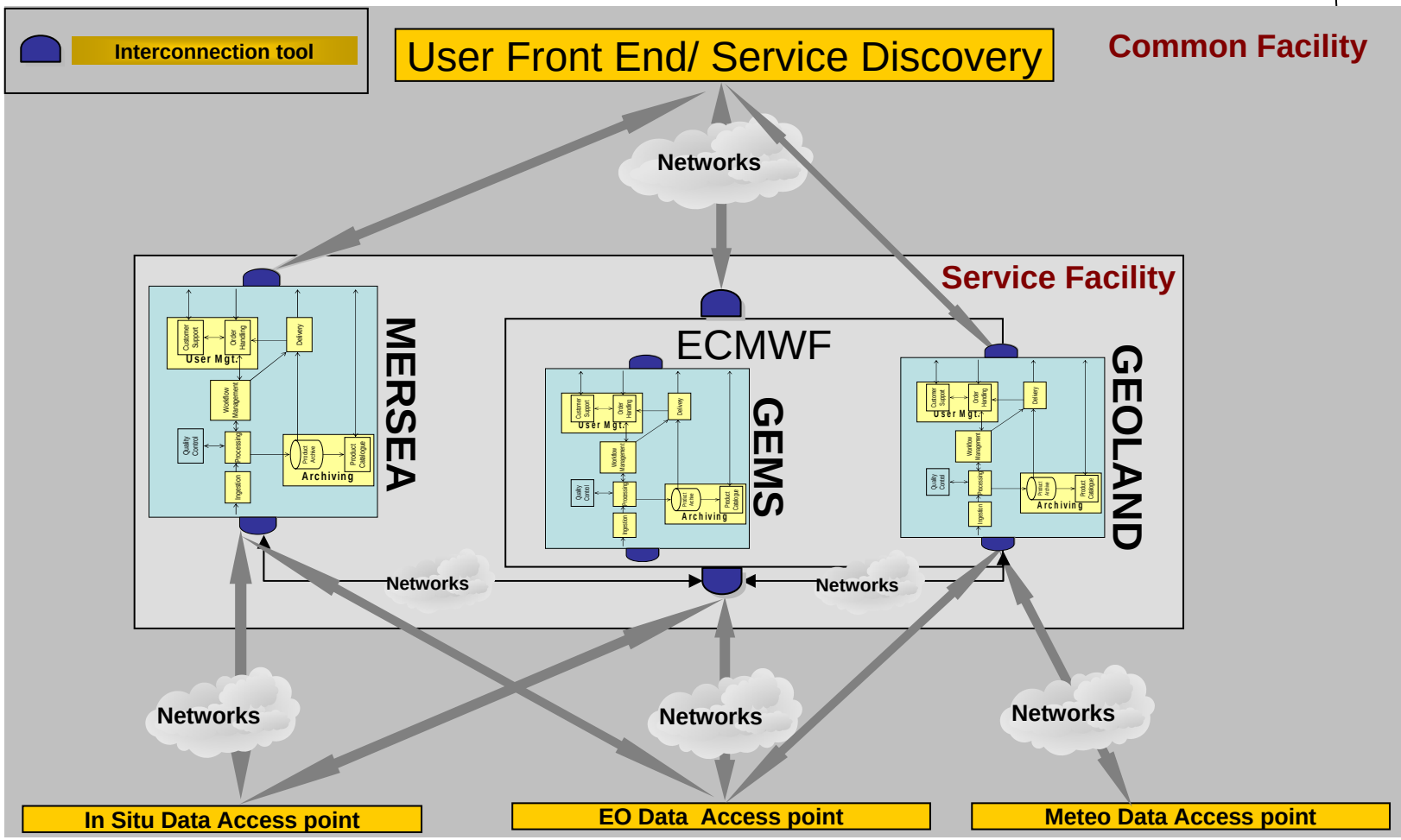
The HALO model identifies two main components:

1. The Service Facility
2. The Common Facility

INFRASTRUCTURE MODEL (2/3) : *Service Facility*



INFRASTRUCTURE MODEL(3/3) : *Common Facility*



In situ data & Models

EO Satellite Agencies

METEO Satellite

HALO DATA FLOW ANALYSIS (1/3)

1. **Direct product exchange**

   Means the products that correspond to a direct data flow from Atmosphere to Land, or Land to Ocean, or Ocean to Atmosphere.

2. **External data flows**

   Correspond to the input data that are produced externally by (EO, Meteo, In-situ data providers).

3. **Internal data flows**

   Correspond to an internal product exchange between services that belong to the same IP or hosted by the same operational entity (e.g ECMWF for Geoland ONC and GEMS)

Operational Constraints

- Real Time Access/Delivery
- Regular Access/Delivery
- On-demand Access/Delivery
- Research Mode only
- Operational Service
- Off-line Service

HALO DATA FLOW ANALYSIS (2/3)

M1/ A5
Data flow: Meteo forcing fields
Criteria: regular, RT analysis
Final product: Meteo forecast/ NWP bulletin

M2/ A3
Data flow: GEMS global Aerosol products
Criteria: research mode (TBC)
Final product: Atmo Aerosol data for Atmo corrections in retrieval

M7
Data flow: RT In-Situ
Criteria: RT Flow
Final product: Argo data in RT or NRT, with QC flags

G1/ A6
Data flow: Meteo forcing fields for land surface models
Criteria: regular
Final product: Air temperature/ Humidity, wind speed, precipitation, incoming radiation

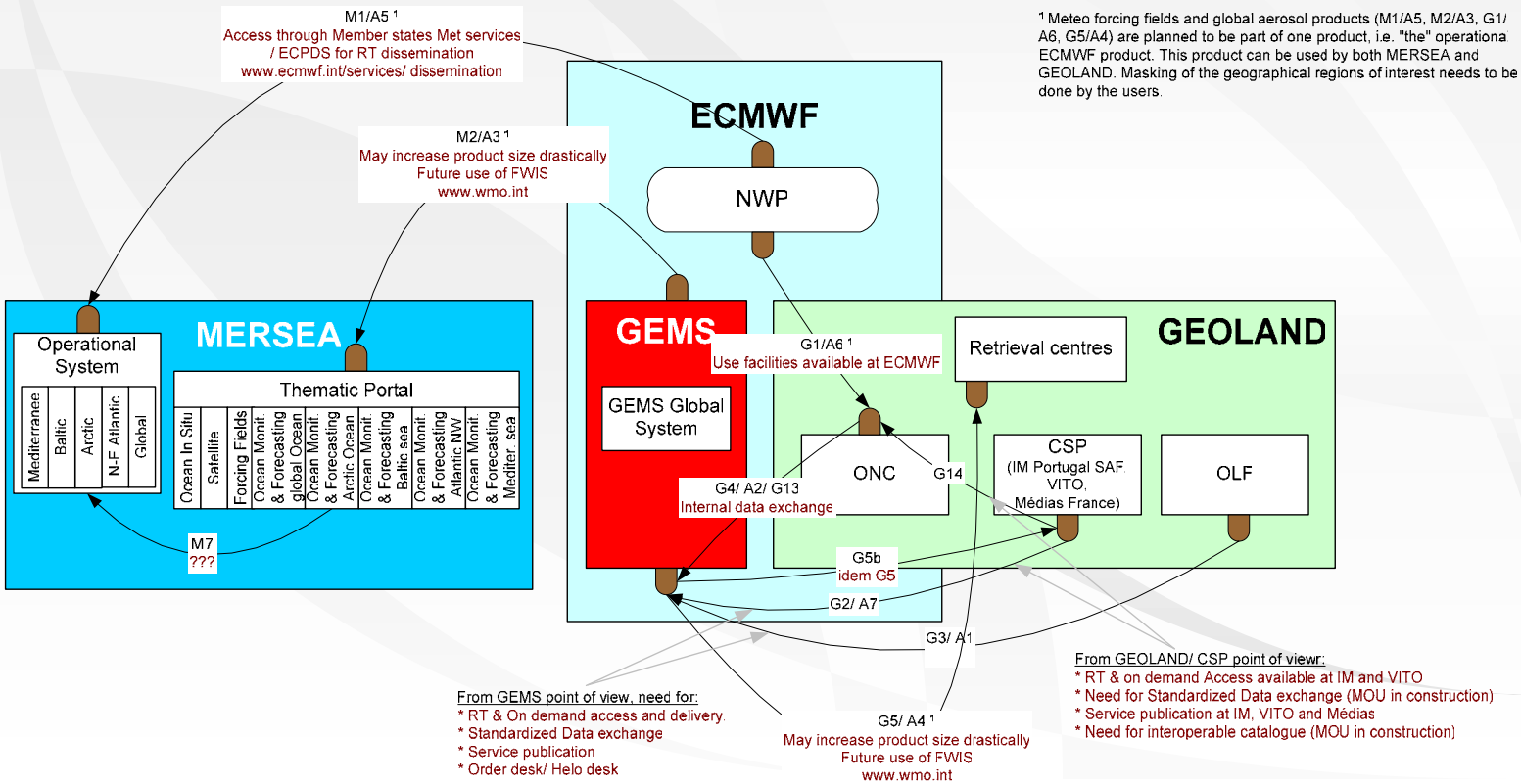
G2/ A7
Data flow: Geoland global products
Criteria: regular + on demand
Final product: Generic Land Cover

G3/ A1
Data flow: Geoland vegetation CO2
Criteria: Research mode (TBC)
Final product: Land use change & forest fires

G4/ A2/ G13
Data flow: Geoland ONC vegetation CO2 & CO2 flux
Criteria: Research mode (TBC)
Final product: Vegetation data as input for emission models

G5/ G5b/ A4
Data flow: GEMS global aerosol products
Criteria: research mode (TBC)
Final product: Atmo Aerosol data for atmo corrections in retrieval

G14
Data flow: Satellite forcing fields for land surface models & LAI
Criteria: regular
Final product: Improved precipitation fields and incoming radiation



HALO DATA FLOW ANALYSIS (3/3)

M3:
Data flow: Satellite data
Criteria: regular
Final product: Along Track, validated

M4:
Data flow: Satellite products
Criteria: regular
Final product: Merged, gridded validated products

M5:
Data flow: In-Situ observations
Criteria: regular + On-demand
Final product: High quality controlled, merged gridded products, climato

M6:
Data flow: In-Situ observations in RT
Criteria: RT Flow
Final product: RT or NRT ARGO data with QC flags

G6:
Data flow: Satellite data
Criteria: regular + On-demand
Final product: information about lanc surface (vegetation, radiation, water)

G7:
Data flow: In-Situ data
Criteria: regular + On-demand
Final product: Rainfall

G8/ A13 :
Data flow: In-Situ data
Criteria: On-demand
Final product: Validation data for vegetation, radiation, soil moisture & GEMS (GHG, GRG, AER, RAQ)

G9:
Data flow: Satellite data
Criteria: On-demand
Final product: Validation data for vegetation & Land cover

G10:
Data flow: Satellite data
Criteria: Regular + On-demand
Final product: land surface & vegetation status

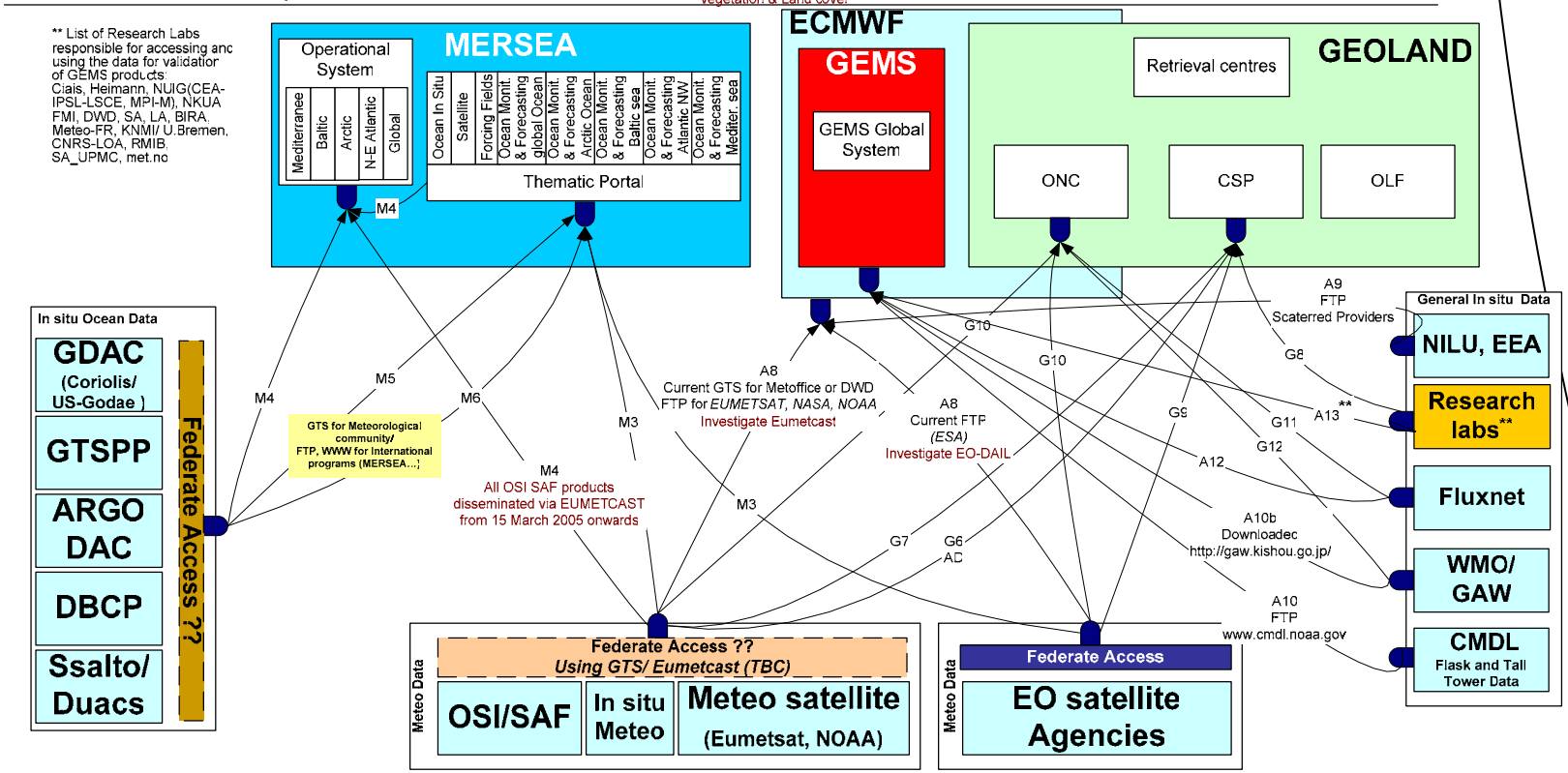
G11/ A12:
Data flow: In-Situ data
Criteria: On-demand
Final product: CO2 & water fluxes

G12:
Data flow: In-Situ data
Criteria: On-demand
Final product: Radiative surface fluxes

A8:
Data flow: Satellite data
Criteria: Operational
Final product: atmo species concentration & Fire burnt area

A9:
Data flow: In-Situ data
Criteria: Regular
Final product: for validation

A10:
Data flow: CO2 concentration
Criteria: On demand
Final product: validation for CO2 assimilation

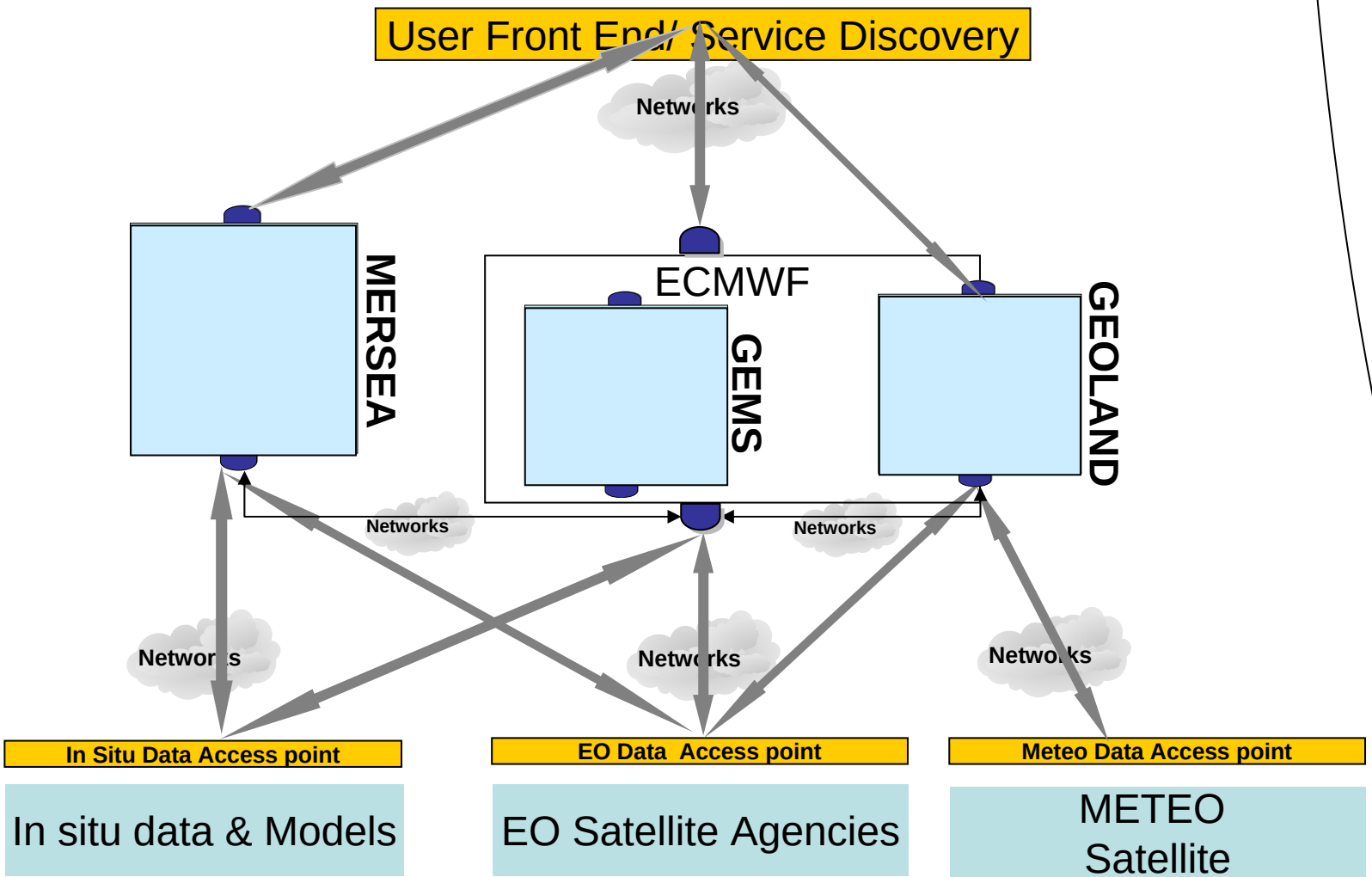


PROPOSED APPROACH

The idea is to complement and organize the existing service infrastructure (from input data access up to end users product delivery) with new Service Support Infrastructure (**SSI**) elements which will allow the building-up of an integrated E2E operational system for the delivery of services.

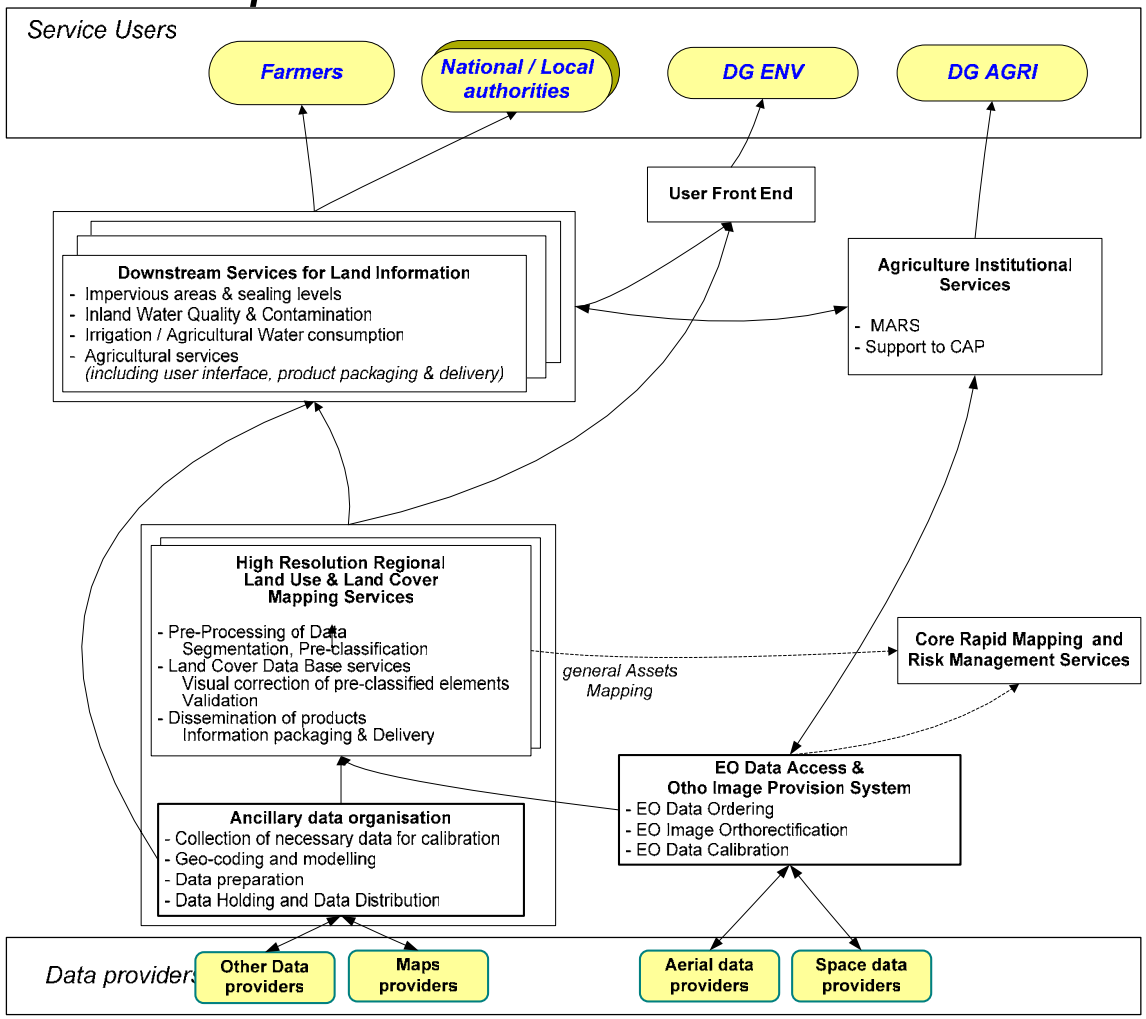
The HALO candidate solutions will finally consist in defining and designing the necessary SSI components based on the key infrastructure issues, the HALO infrastructure model and on the data flows analysis. In this context, the proposed SSI solutions should first of all answer to the following questions: =>

1. Which network for HALO data transfer?
2. Which Access to EO, meteo & in-situ Data?
3. How to manage interconnection and interoperability ?
4. Which reusable relevant components or concepts (WIN, …)



FROM…….

Example: Fast track Land Services



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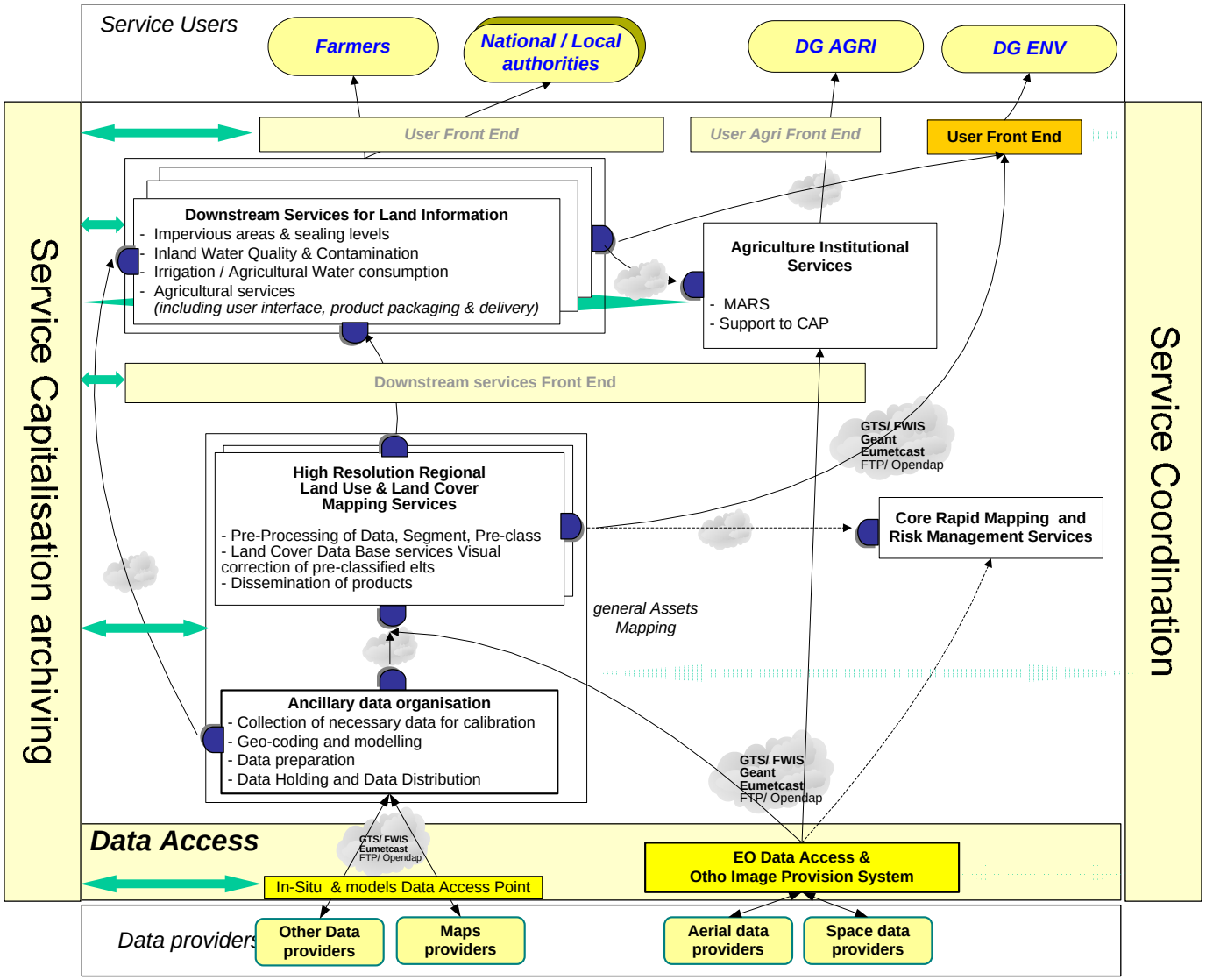
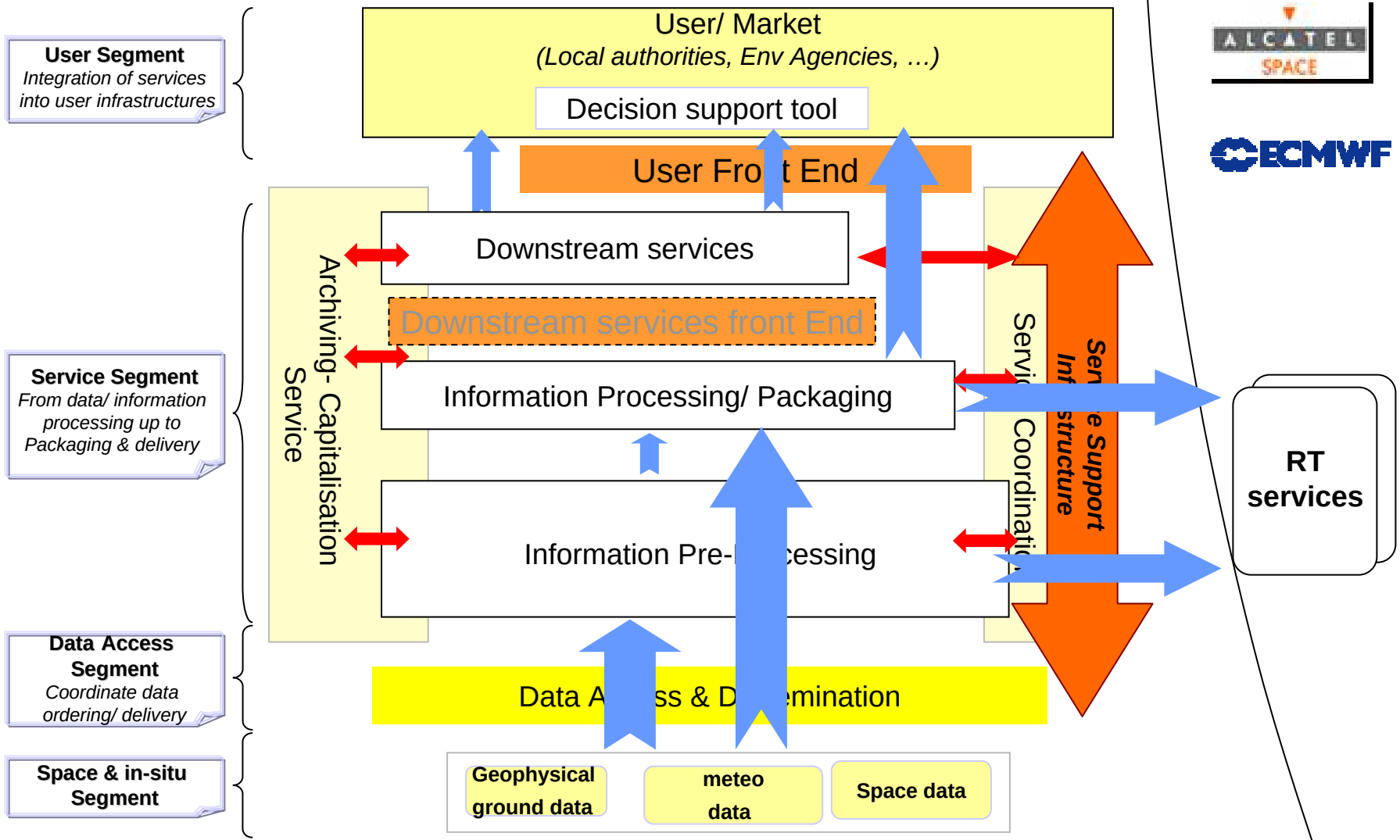

Service Users
Farmers
National / Local authorities
DG AGRI
DG ENV
User Front End
User Agri Front End
User Front End
Service Capitalisation archiving
Service Coordination
Downstream Services for Land Information
- Impervious areas & sealing levels
- Inland Water Quality & Contamination
- Irrigation / Agricultural Water consumption
- Agricultural services
(including user interface, product packaging & delivery)
Agriculture Institutional Services
- MARS
- Support to CAP
Downstream services Front End
GTS/ FWIS
Geant
Eumetcast
FTP/ Opendap
High Resolution Regional Land Use & Land Cover Mapping Services
- Pre-Processing of Data, Segment, Pre-class
- Land Cover Data Base services Visual correction of pre-classified elts
- Dissemination of products
Core Rapid Mapping and Risk Management Services
general Assets Mapping
Ancillary data organisation
- Collection of necessary data for calibration
- Geo-coding and modelling
- Data preparation
- Data Holding and Data Distribution
GTS/ FWIS
Geant
Eumetcast
FTP/ Opendap
Data Access
GTS/ FWIS
Eumetcast
FTP/ Opendap
In-Situ & models Data Access Point
EO Data Access & Otho Image Provision System
Data providers
Other Data providers
Maps providers
Aerial data providers
Space data providers

E2E SERVICE CHAIN OVERVIEW



SERVICE SUPPORT INFRASTRUCTURE ELEMENTS

Which network for data transfer?

Data transfer in HALO could be based on the following networks

- Meteorological networks GTS/RMDCN (WMO) & Future WMO Information System (FWIS)
- Dedicated Networks such as EumetCast, ARGOS or GEANT
- Mobile networks such as Inmarsat, Iridium

SERVICE SUPPORT INFRASTRUCTURE ELEMENTS

Which network for data transfer?

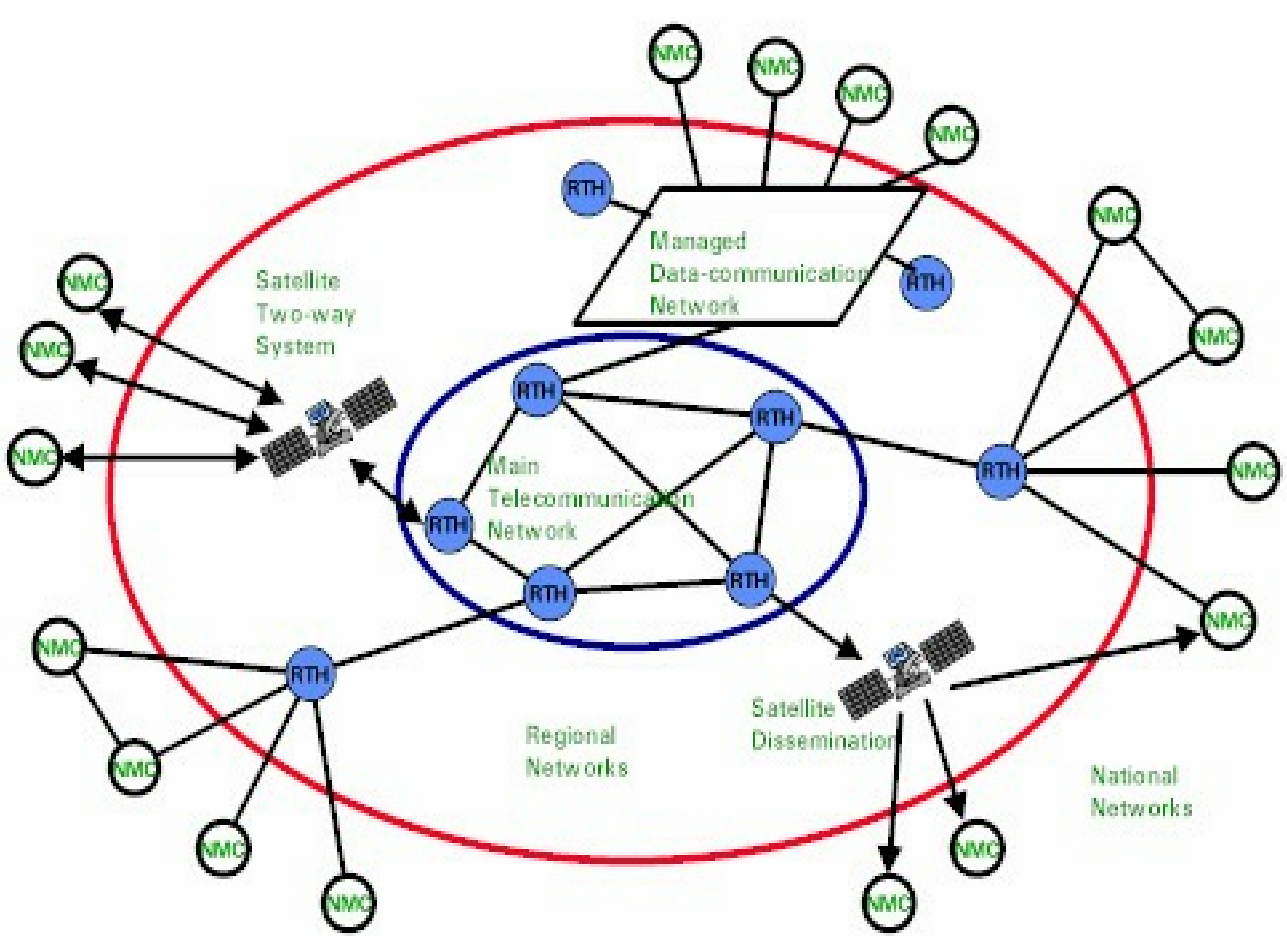
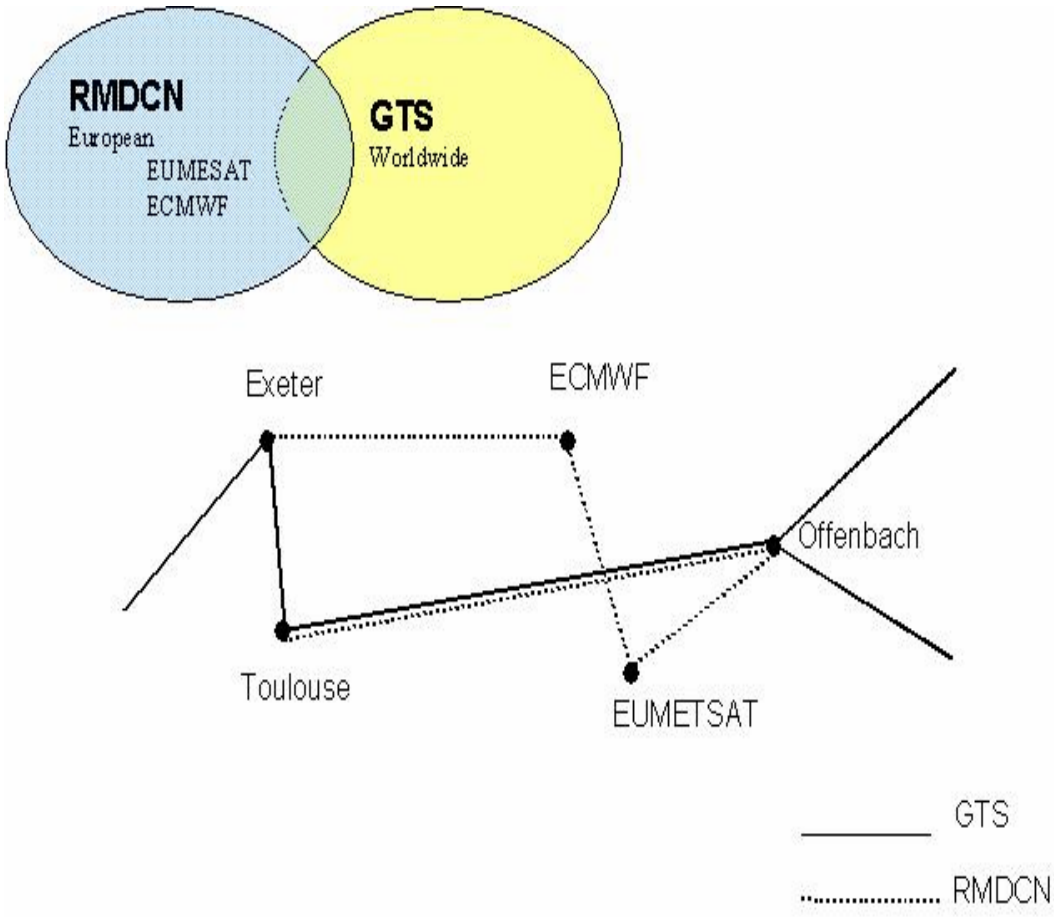


Figure 1 - Structure of the Global Telecommunication System

SERVICE SUPPORT INFRASTRUCTURE ELEMENTS

Which network for data transfer?

Meteo Satellite Server



SERVICE SUPPORT INFRASTRUCTURE ELEMENTS

Which network for data transfer?

The **GTS (RMDCN)/ FWIS** network should be used to deliver some of the HALO interacting and external data. MERSEA access to meteorological field data and in situ observations already relies on GTS (RMDCN). GEMS and ONC, both hosted at ECMWF, will have access to GTS (RMDCN) too.

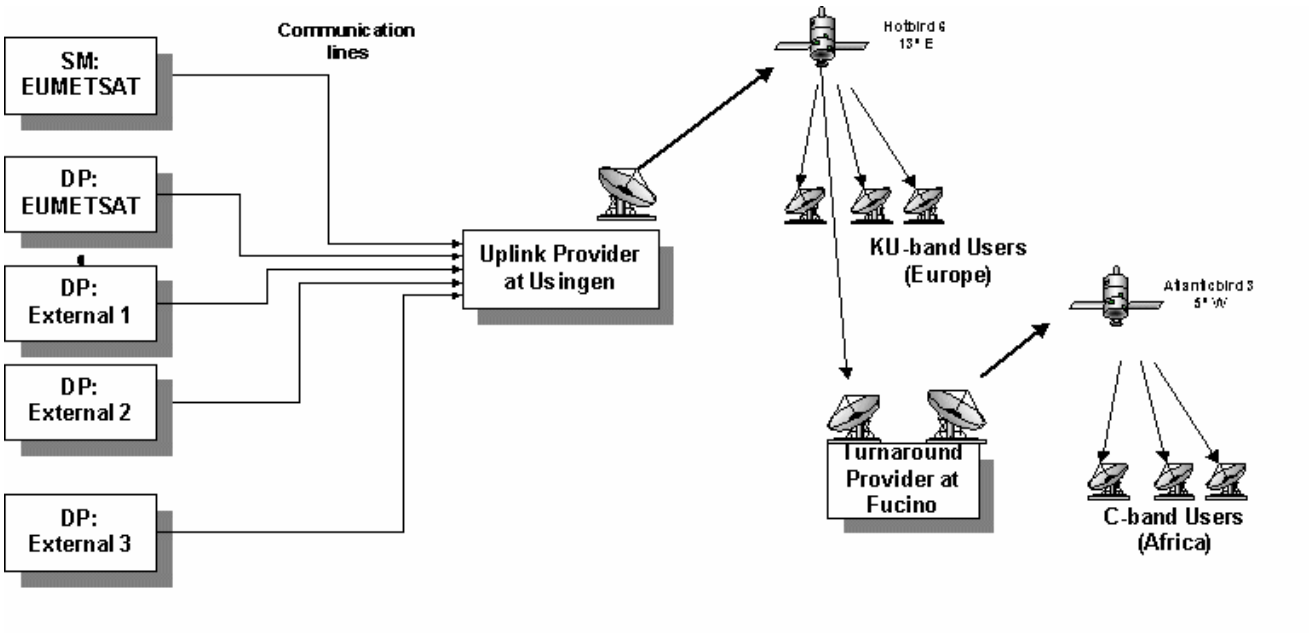
Geoland CSP & OLF should also access to meteorological field data and-in situ observations relying on GTS (RMDCN). Moreover, interacting data flows could also be delivered using GTS (RMDCN)/FWIS, in particular: **To be discussed**

- Geoland-OLF=> GEMS vegetation CO2 for land use change & forest fires (G3/A1)
- Geoland-CSP => GEMS global products for generic land cover (G2/A7)
- Geoland-CSP > ONC Satellite forcing fields for land surface models (G14) for improved precipitation fields and incoming radiation
- GEMS => Geoland global aerosol products (G5/G5b/A4) atmospheric aerosol data for atmospheric correction in retrieval
- MERSEA ocean parameters (e.g. SST) toward ECMWF (TBC)

SERVICE SUPPORT INFRASTRUCTURE ELEMENTS

Which network for data transfer?

Eumetcast is primarily used for the distribution of image data and derived products from EUMETSAT's own satellites. In addition, EUMETCast provides access to data and services provided by several external data providers.



SERVICE SUPPORT INFRASTRUCTURE ELEMENTS

Which network for data transfer?

Eumetcast already provides access to data and services provided by several external data providers (see Table 5-2) nevertheless, additional external in-situ, EO and meteo data could be provided using this network, in particular (TBC):

- Meteo satellite data (Eumesat, NOAA) => GEMS for atmospheric species concentration & fire burnt area (A8)
- Meteo satellite data => Geoland-CSP for information about land surface (vegetation, radiation, water) (G6)
- In situ data => Geoland-CSP for rainfall (G7).
- Meteo & EO satellite data => Geoland-ONC for land surface & vegetation status (G10).
- EO satellite data => Geoland-CSP for validation data for vegetation & land cover (G9).
- EO and meteo satellite data => GEMS for along track, validated (M3).

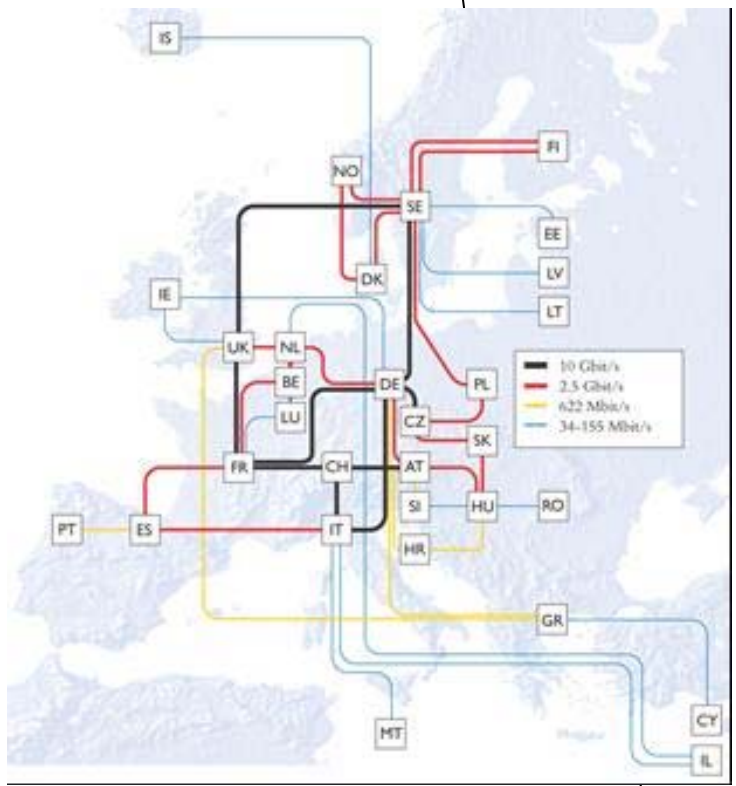
SERVICE SUPPORT INFRASTRUCTURE ELEMENTS

Which network for data transfer?

GÉANT is a pan-European multi-gigabit data communications network, reserved specifically for research and education use. It is creating the biggest interconnected community of scientists and academics in the world today, enabling them to share and distribute research data faster than ever before.

GÉANT supports researchers by allowing them to:

- Rapidly transfer large quantities of data at up to 10Gbps
- Make use of advanced network applications such as grid computing
- Collaborate on research projects in real-time



SERVICE SUPPORT INFRASTRUCTURE ELEMENTS

Which network for data transfer?

Géant layer 2 Virtual Private Networks (VPNs) could be used by HALO /GMES service providers that needs to rapidly transfer data between each other.

The Layer 2 VPNs are point-to-point connections linking two sites. Typically, these will be two sites which are each connected to a different network. Using a Layer 2 VPN, the two sites can communicate as though they were directly connected to each other. For instance Géant VPN could be used to transfer (TBC):

- MERSEA => ECMWF ocean parameters (e.g. SST)
- Geoland-CSP => GEMS global products for generic land cover (G2/A7)
- Geoland-CSP => ONC Satellite forcing fields for land surface models (G14) for improved precipitation fields and incoming radiation
- Geoland-OLF => GEMS vegetation CO2 for land use change & forest fires (G3/A1)

SERVICE SUPPORT INFRASTRUCTURE ELEMENTS

Which network for data transfer?

Standard ftp connection will be used for all kind of data exchange not covered by GTS or dedicated networks.

Data transfer via Internet using the Opendap protocol (Distributed Oceanographic Data System **DODS**) allows a flexible way to exchange data from various data centres. Live Access Severs using OPeNDAP are widely used in the Ocean community. Their application could be expanded in order to access field data for all IPs such as (TBC):

- CMDL, GAW => GEMS CO2 concentration (A10) validation for CO2 assimilation.
- Fluxnet => GEMS In-situ data for validation (A12) for CO2 fluxes
- Fluxnet => Geoland-ONC In-situ data (G11) for CO2 and water fluxes
- GAW => Geoland In-situ data for validation (G12) for radiative surface fluxes
- Research Lab => GEMS In-situ correlative data (A13)
- Research Lab => Geoland-CSP In-situ data (G8) for validation data for vegetation, radiation, soil moisture products toward

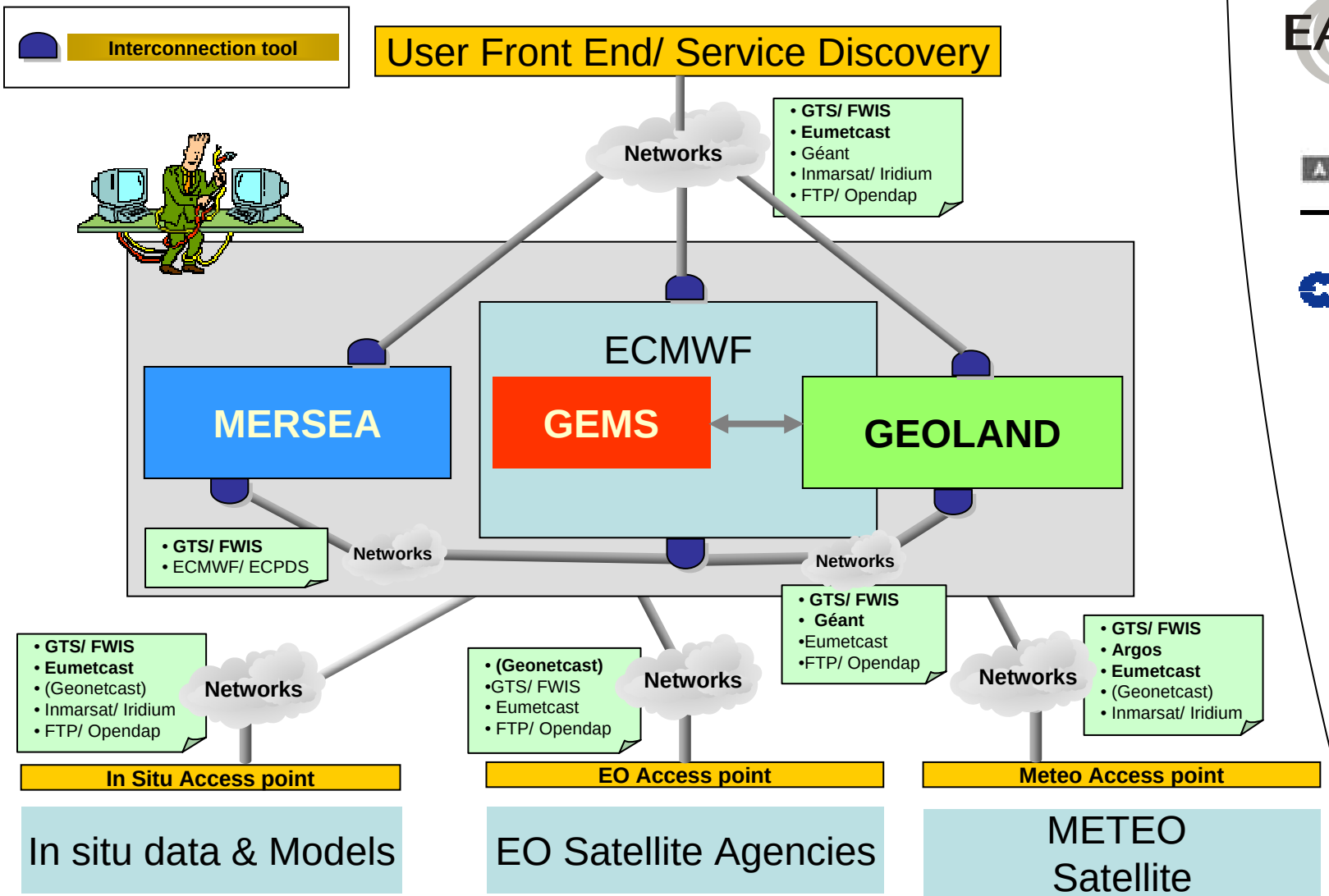
SERVICE SUPPORT INFRASTRUCTURE ELEMENTS

Which network for data transfer?

"GEONetcast" is a major GEOSS initiative to develop a worldwide, operational, end-to-end Earth observation data collection and dissemination system, using existing commercial telecommunications infrastructure.

GEONetcast will collect and disseminate **space-based and in-situ derived data**, metadata, and products for all GEO societal benefit areas.

"GEONetcast" is a 2006 GEOSS special initiative with whom HALO should coordinate.


Interconnection tool
User Front End/ Service Discovery
Networks
• GTS/ FWIS
• Eumetcast
• Géant
• Inmarsat/ Iridium
• FTP/ Opendap
ECMWF
MERSEA
GEMS
GEOLAND
• GTS/ FWIS
• ECMWF/ ECPDS
Networks
Networks
• GTS/ FWIS
• Géant
•Eumetcast
•FTP/ Opendap
• GTS/ FWIS
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• GTS/ FWIS
• Argos
• Eumetcast
• (Geonetcast)
• Inmarsat/ Iridium
Networks
In Situ Access point
EO Access point
Meteo Access point
In situ data & Models
EO Satellite Agencies
METEO Satellite

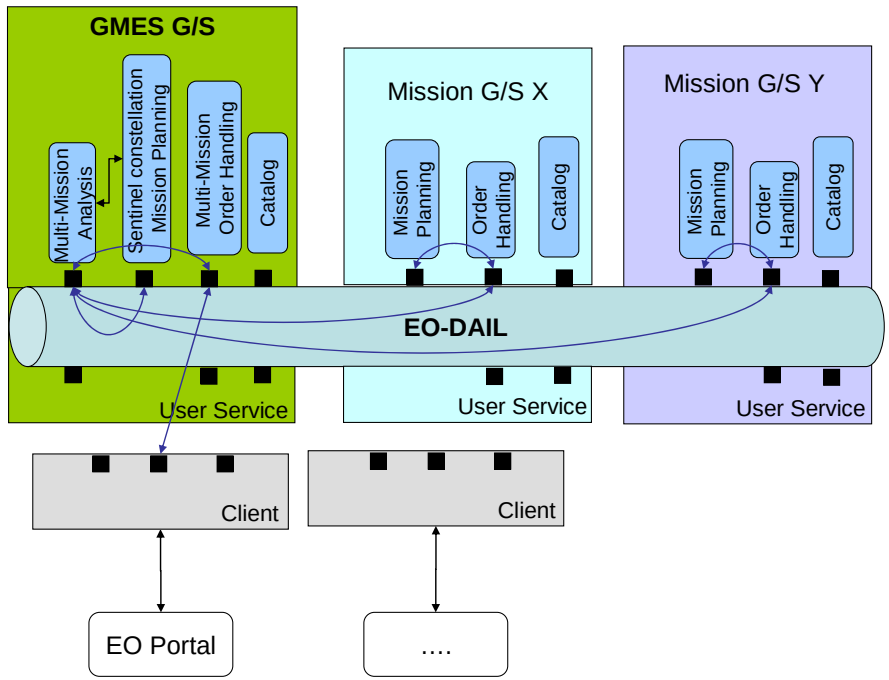
SERVICE SUPPORT INFRASTRUCTURE ELEMENTS

Which Access to EO Data ?

ESA has initiate a specific “Heterogeneous Mission Accessibility (**HMA**)”study that aims at specifying, designing and prototyping the EO Data Access Integration Layer (**EO DAIL**) of the future European Earth Observation Ground Segment (G/S).

The EO DAIL will allow a user to communicate with the G/Ss of several missions through a single set of interfaces

EO DAIL Scope:



SERVICE SUPPORT INFRASTRUCTURE ELEMENTS

Which Access to meteo Data ?

The WMO Information System (WIS) is an overreaching approach and a single coordinated global infrastructure for the collection, distribution, retrieval of, and access to data and information of all WMO and related Programmes.

The Future WMO information System (FWIS) is an **overarching approach** to meet information exchange requirements of all WMO Programmes. It will help WMO to avoid and eliminate data incompatibilities, and undue limitation in the sharing of highly valuable data between various programmes. It will ensure interoperability of Information Systems between WMO Programmes and outside of the WMO community.

WMO activities

- Agroclimatology
- Measurements
- Natural disasters
- Satellites
- Hydroclimatology
- Polar climatology
- Public weather services
- Oceanography
- Technical cooperation

Example of NEAR-GOOS

is the North-East Asian Regional GOOS is Regional pilot project of the Global Ocean Observing System (GOOS),

is being implemented by China, Japan, the Republic of Korea and the Russian Federation.

is intended to provide a regional framework for gathering and distributing oceanographic data in the North-East Asian region, in enabling participating countries to make better use of their investments in ocean observations and research towards the establishment of the Global Ocean Observing System. Oceanographic data and relevant products generated within

NEAR-GOOS system will be open at free cost through electronic communications for various forms of marine uses.

- Data Producers provide In situ observation data, Remote sensing data,Numerical Model Output

  Each data producer in the NEAR-GOOS regions is advised to make proper efforts to minimize time in retrieving and analyzing the observational data, and to make the data available to users through the Internet, to ensure quality, provision of readable graphs, informations.

Example of NEAR-GOOS

- Some Operational DataBases
  - are available at National, Regional level

Real Time Data Bases (RTDB) The National Real Time Data Base can collect all the data in the region from other National and Regional Real Time Data Bases and provide them to domestic users for more efficient services

Delayed Mode Data Bases (DMDB)

  - are managed by centres as The Japan Meteorological Agency (JMA) and the Japan Oceanographic Data Centre (JODC)

- Free Registration
  - The NEAR-GOOS data should be accessible, free of charge, to all users who are interested in obtaining the data. To ensure the security of the Data Bases, a password system can be introduced.
  - National and Regional Data Bases for NEAR-GOOS and the participating data producers which make their data available on their servers should have on-line registration capability to collect the user information for the monitoring of the data exchange system.

Data collect, Argos Example

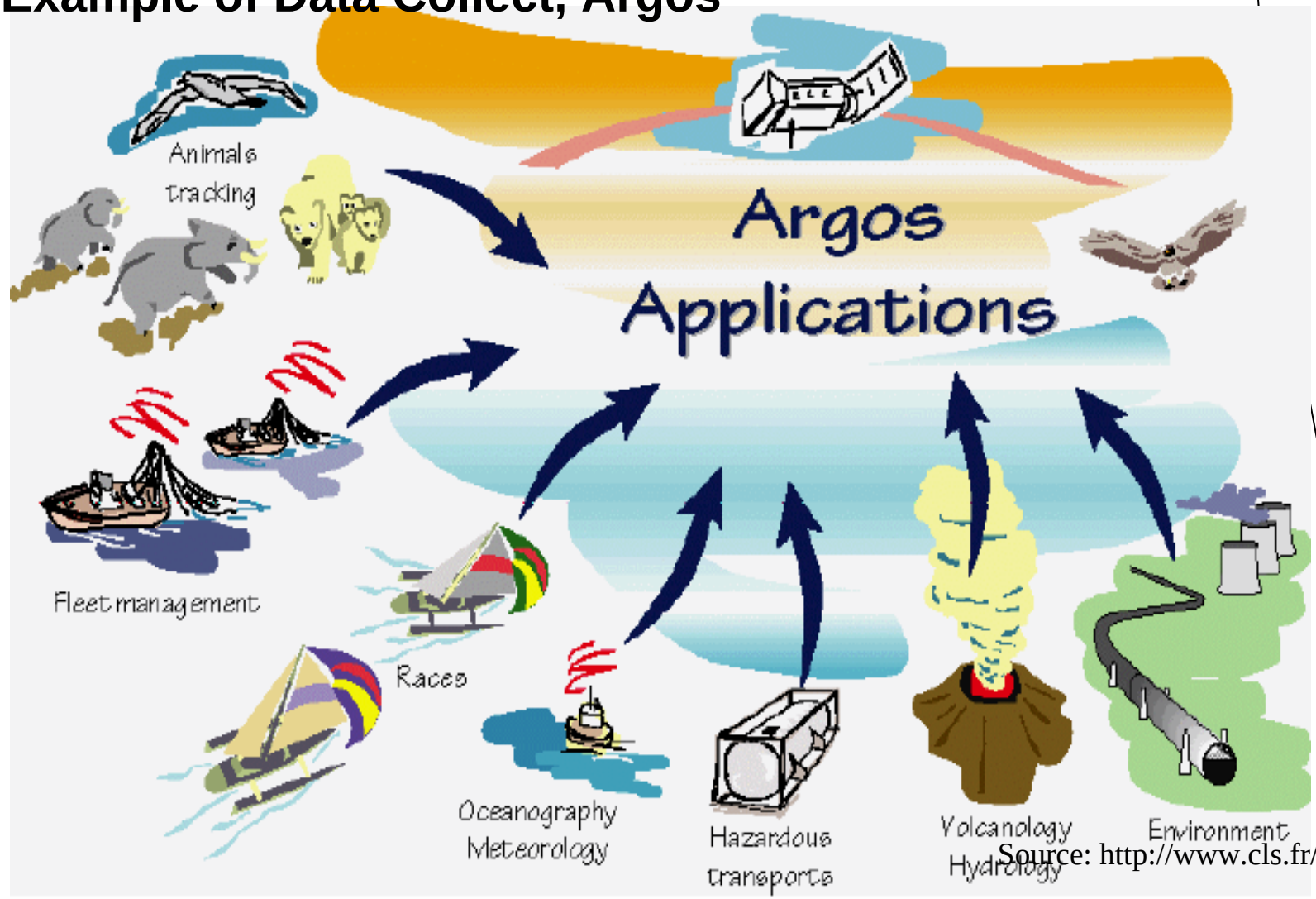
Automatic Data collect systems are necessary for environmental monitoring (including risk issues)

- 24h/24h monitoring
- All year long
- Automatically data collect processes
- Large spectrum of sensor
- Various transmission vectors
- Other advantages:
  - It does not need many maintenance
  - It can be located in any terrain and climate
  - It is more reliable than human for fastidious task
  - It reduces the cost of useful information

SERVICE SUPPORT INFRASTRUCTURE ELEMENTS

Which Access to in-situ Data ?

Example of Data Collect, Argos



Source: http://www.cls.fr/manuel/

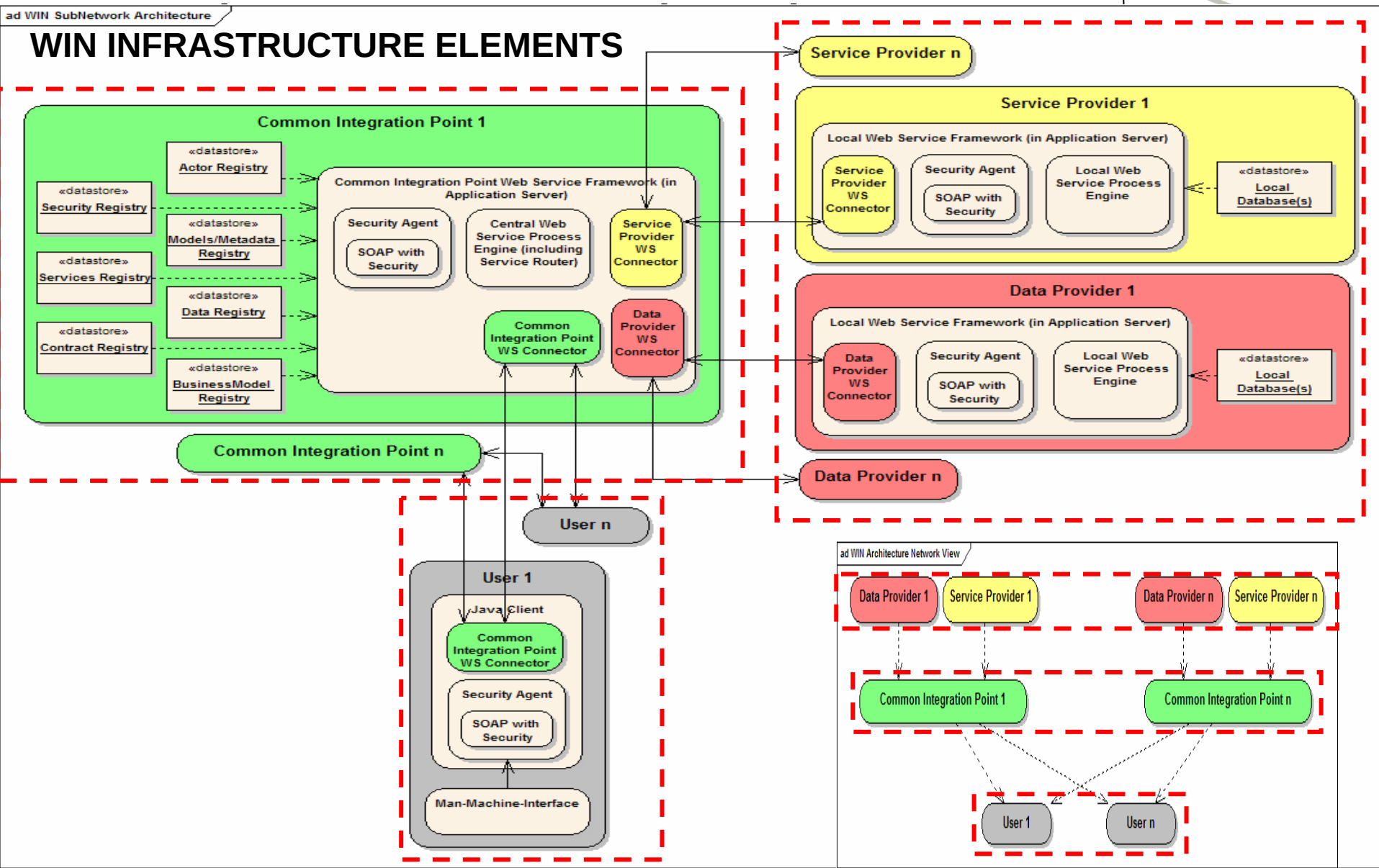
Argos data delivery

- **GTS Subsystem**
  - These data are usually relayed onto the Global Telecommunications System (GTS), a world-wide operational system for the sharing of meteorological and climate data. Argos established a powerful Argos/GTS processing subsystem to simplify the transmission of data directly onto the GTS. The system provides maximum flexibility in processing sensor data. This has resulted in increased quantity and quality of Argos data on the GTS.
- **Automatic Distribution Service (ADS)**
  - ADS supplies results automatically, either at fixed times, which are User-defined, or whenever new data become available. The User specifies the most appropriate distribution network. For example, in the US, many users are taking advantage of the Internet to receive their data via FTP or email. There is no need to interrogate Argos on-line since data is delivered automatically to the User's system.

SERVICE SUPPORT INFRASTRUCTURE ELEMENTS

Which Access to in-situ Data ?

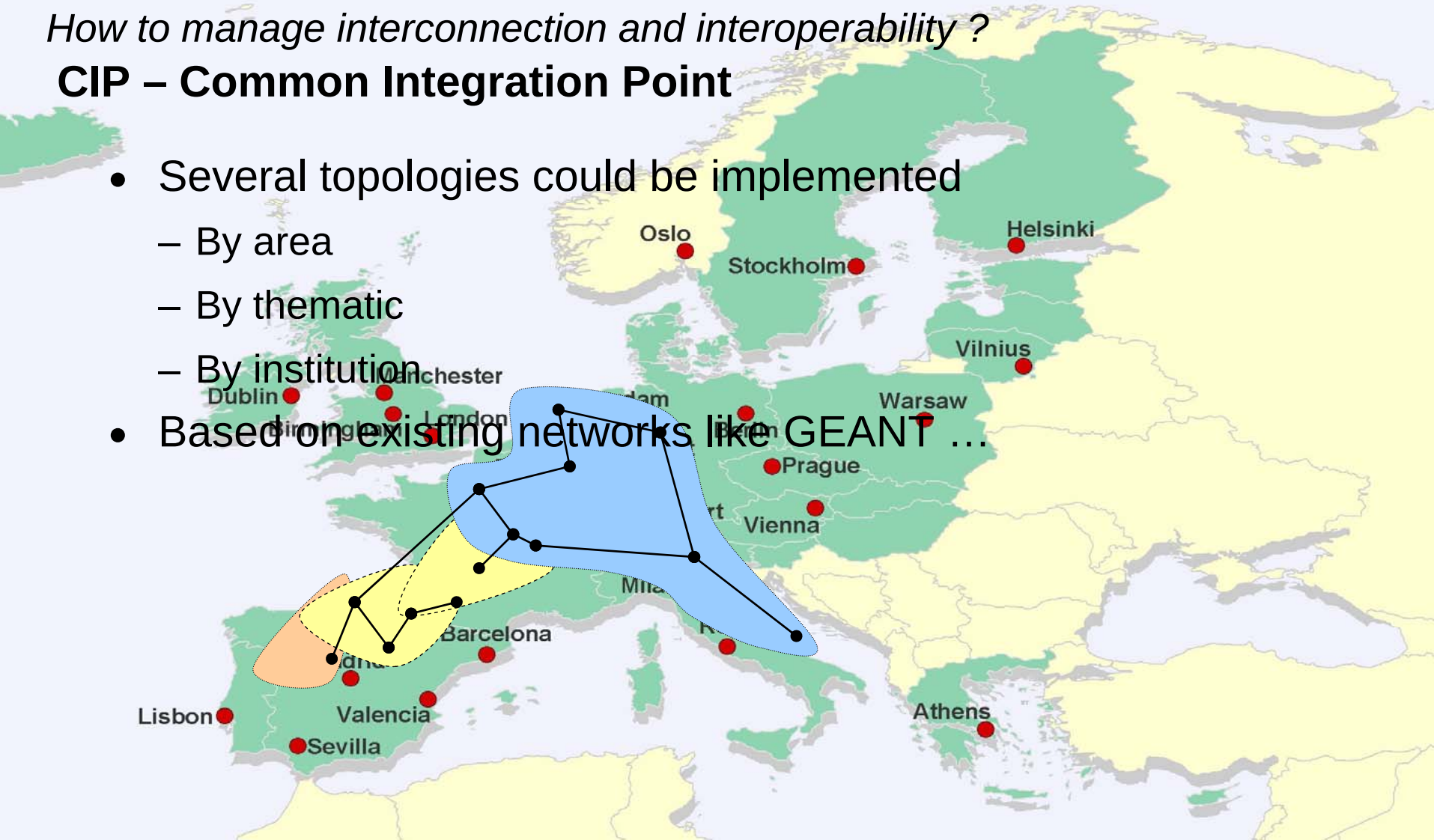
EADS ASTRIUM



How to manage interconnection and interoperability ?

CIP – Common Integration Point

- Several topologies could be implemented
  - By area
  - By thematic
  - By institution
- Based on existing networks like GEANT …



SERVICE SUPPORT INFRASTRUCTURE ELEMENTS

How to manage interconnection and interoperability ?

The HALO infrastructure will be built upon network of services facilities & infrastructure, this implies to set-up full interoperability between services facilities in order to establish communication and share data. Interoperability will be achieved by linking the services facilities by common **standards** and **protocols**.

As mentioned previously, the idea is to complement and organize the existing service infrastructure with new Service Support Infrastructure (**SSI**) elements which will allow the building-up of an integrated end-to-end operational system for the delivery of services.

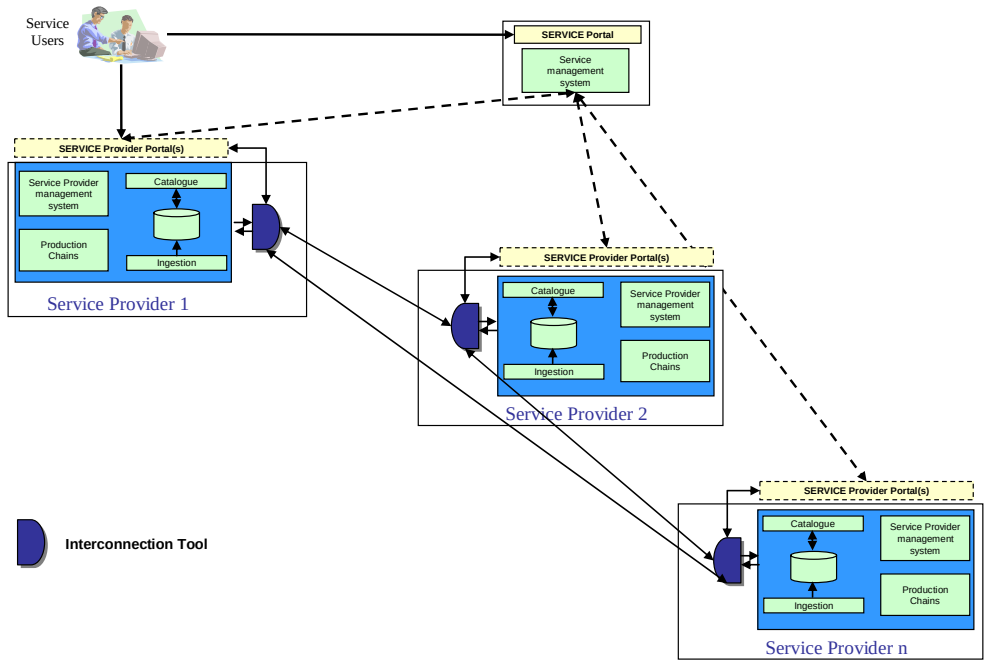
In particular, the SSI will include elements that will ensure optimal “communication” between “actors” using interoperability standards issued by INSPIRE, OGC and other relevant initiatives.

SERVICE SUPPORT INFRASTRUCTURE ELEMENTS

How to manage interconnection and interoperability ?

Communications between actors could be managed by a dedicated SSI element called: "Interconnection Tool" implementing interconnection standards and components to manage of service chaining (Workflow, registry, publication, DRM, Security, …).

This "Interconnection tool" will be usable by any service provider to organise and manage locally its interfaces with its customers and suppliers. At the global level, from a service chain point of view, the global process execution will rely on the coordination of individual nodes.



SERVICE SUPPORT INFRASTRUCTURE ELEMENTS

Which reusable relevant components or concepts (WIN, …) **?**

Generic requirements overview

- For In-situ Data
  - Access to Distributed Data Collection
  - Use Low Bandwidth Communications
  - Get Large Data handling and Archiving (Especially Over Time)
  - Access Web Interface to Data for a Range of (Access Limited) Users (likely to be XML-based in near-term)
  - Have Global Standards for :
    - Data Storage,
    - Data Access,
    - Data Querying,
    - Data Transfer,
    - Data Ingestion into assimilation models,

Source: TEASE study 2003

Generic requirements overview

- Information products are mainly GIS products (vector formats) with low data volume
  - EO Products (10 to 500 MB) --> Information Products (0,1 to 1 MB)
  - Data compression is very recommended
- Telecom services
  - Secured and reliable Distribution networks
  - Strategic links between operational actors
  - Exchange of relevant information whatever the situation and the disaster location
  - Facilitate expertise and decision aid activities within Collaborative Working Networks

Communication requirements

- Service requirements
  - Transmission of measuring data from fixed, land-mobile, flying and floating platforms to data acquisition center
  - Data exchange between ecological information systems, data acquisition centers and users
  - Distribution of environmental information from the data acquisition centers and databases to user communities
- Communication services
  - Data collection service for the transfer of the measured ecological data from sensors to a remote collecting facility
  - Data distribution for the delivery of the collected data to various users end exchange of processed information between users
    - point-to-point for the data exchange between 2 facilities
    - broadcasting for the distribution to a large number of users simultaneously

Security Requirements

- Access control and security functions:
  - Authentication
  - Confidentiality
  - Content integrity
  - Non repudiation
  - Replay protection
  - Access authorisation
  - Standard protocols : SSL (Secure Socket Layer) , IPsec (Secured IP) VPN (Virtual Private Network) :

SERVICE SUPPORT INFRASTRUCTURE ELEMENTS

Which reusable relevant components or concepts (WIN, …) **?**

From Orchestra

Semantic Catalog component

From WIN

Service-Oriented Architecture – SOA

Common component CIP/Order deposit

Archiving : Catalogue Component

From INSPIRE

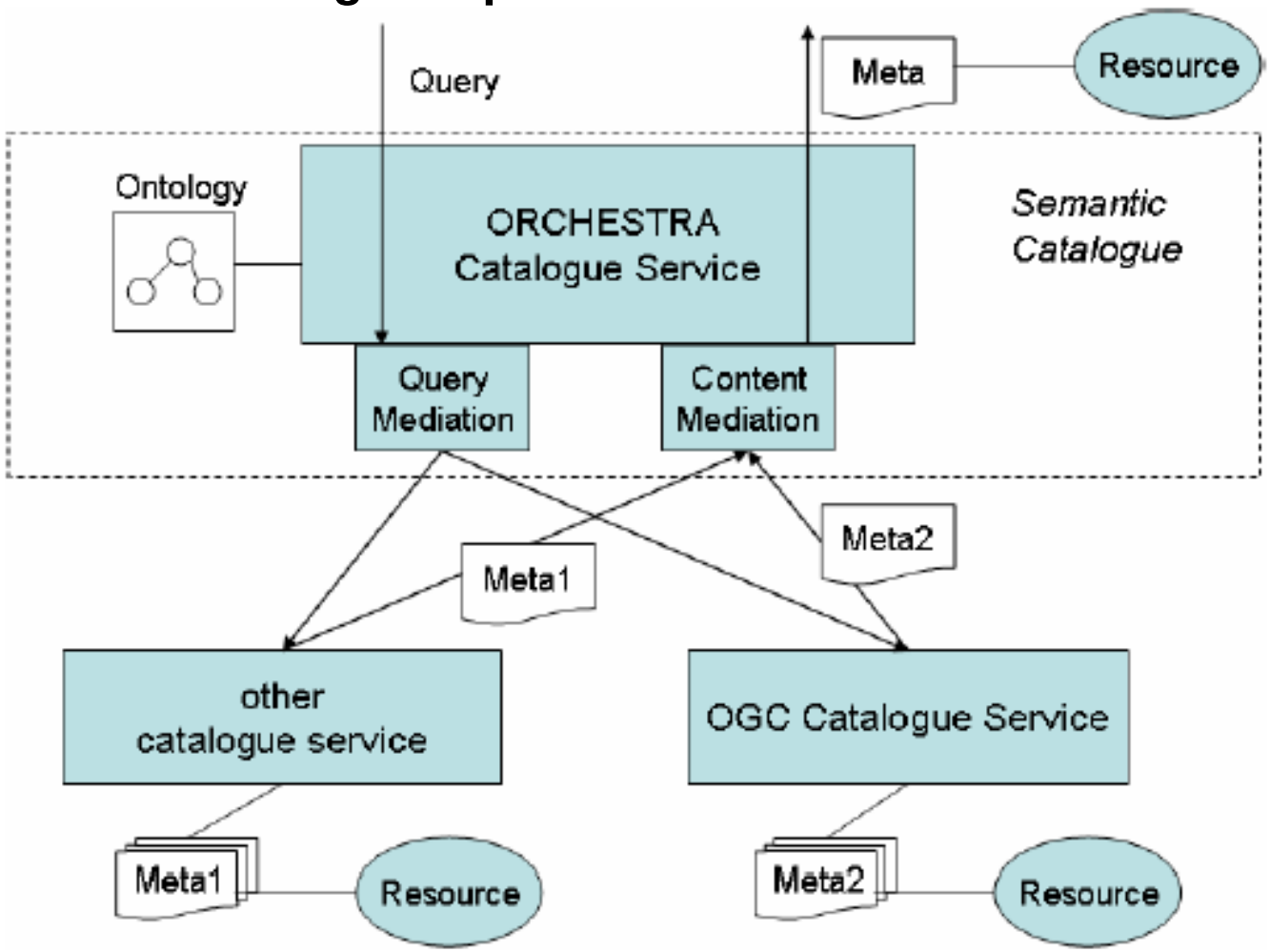
Standards, OGC

Common Driving Requirements (security, interoperability,…)

SERVICE SUPPORT INFRASTRUCTURE ELEMENTS

Which reusable relevant components or concepts (WIN, …) **?**

Semantic Catalog component

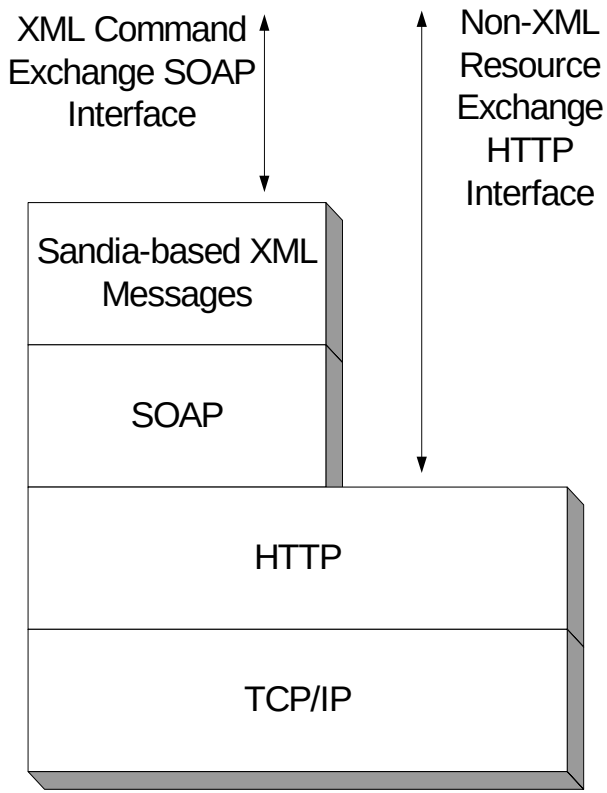


SERVICE SUPPORT INFRASTRUCTURE ELEMENTS

Which reusable relevant components or concepts (WIN, …) **?**

In-situ Data Server

WIN Technology



SERVICE SUPPORT INFRASTRUCTURE ELEMENTS

Which reusable relevant components or concepts (WIN, …) **?**

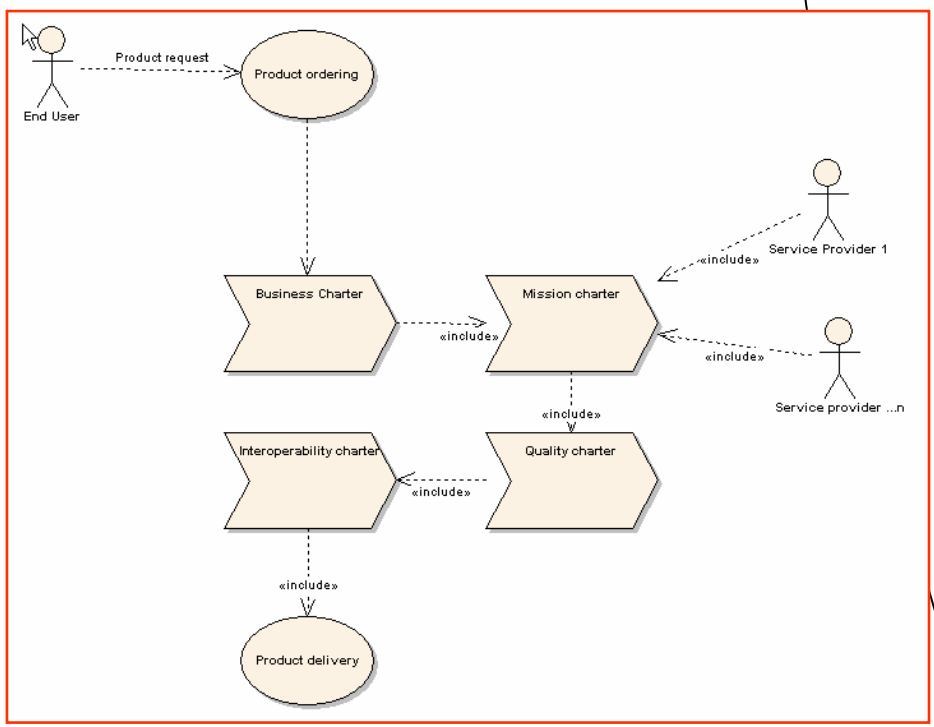
Generic services shared for all users

- Users management
- Users registration, database management…

- Security
  - Cryptology, Antivirus, Intruder sensor…
- Administration
  - Backup, archiving, deployment…
- Data access
  - Meta-catalogue
  - Data mining
- Services directory
  - Registration of new services into the Open Platform
  - Services catalogue
- Workflow management
  - Chaining process according to a defined set of rules to achieve, or contribute to an overall business goal
- Human Language Interoperability
  - Terminology glossary
  - Structures / Ontologies
- Help desk services
- Object Viewer and GIS services
- Collaborative working services

Charters

- Charters are involve into :
  - Process management
  - Interoperability management
  - Quality insurance
  - Billing

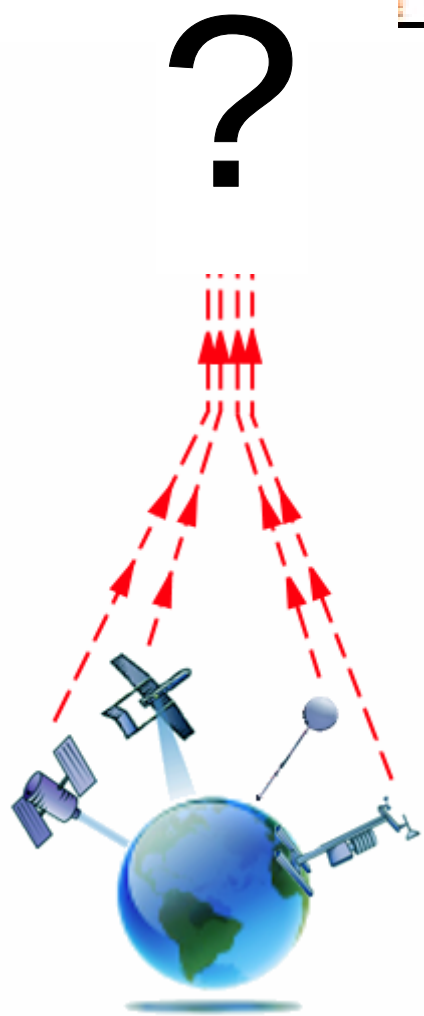


SERVICE SUPPORT INFRASTRUCTURE ELEMENTS

Which reusable relevant components or concepts (WIN, …) **?**

IONIC, a solution to :

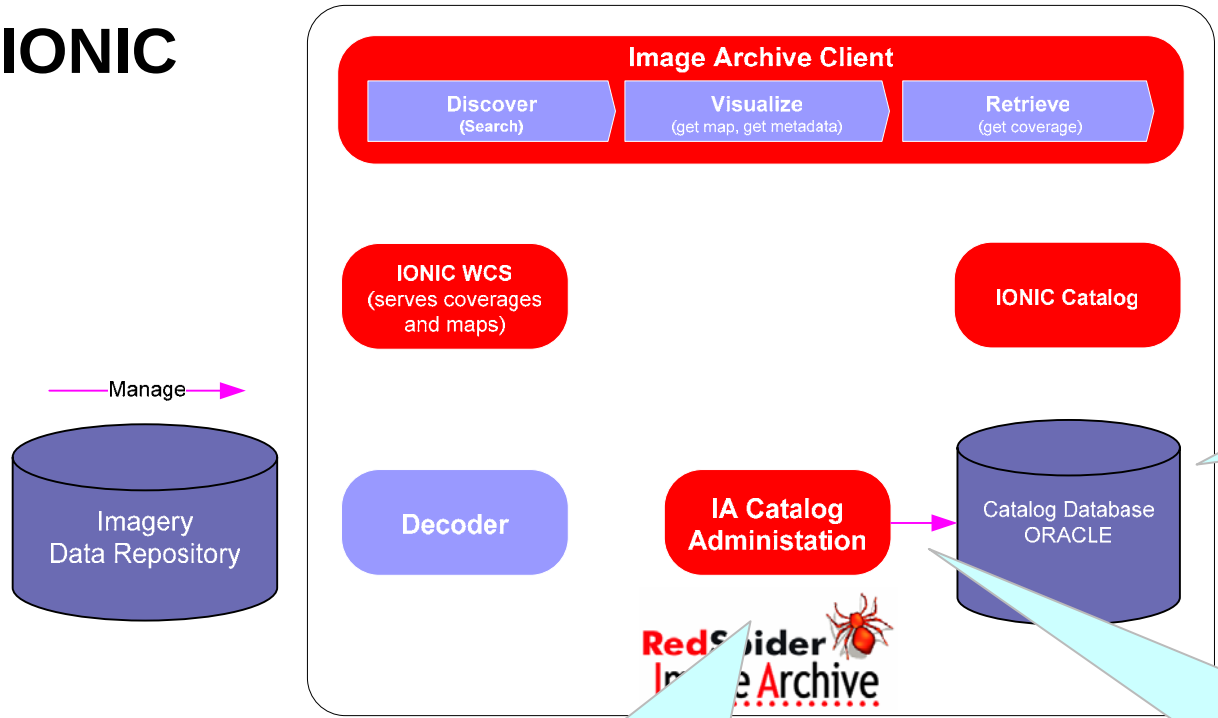
- **Index** dynamically a big flux of data for a fast data access
- **Manage** and classify a big amount of data per theme and hierarchically
- **Publish** data on the Web towards a community of users
- Provide means for easy an ergonomic **research** through advanced research criteria
- **provide** raw data for analysis, processed data and rendered for data mining

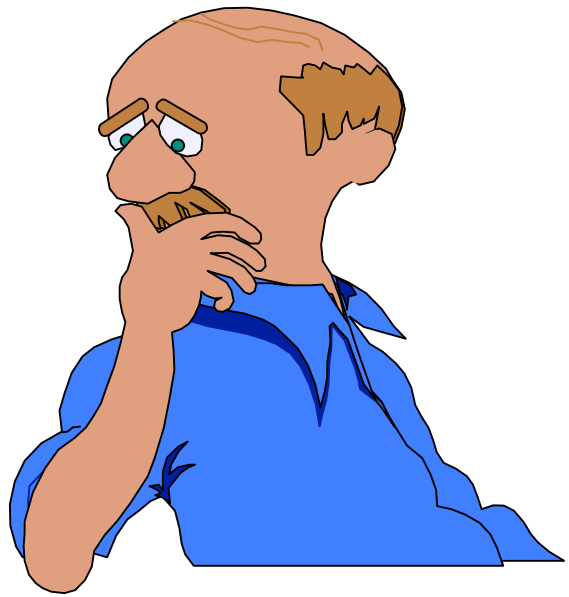


SERVICE SUPPORT INFRASTRUCTURE ELEMENTS

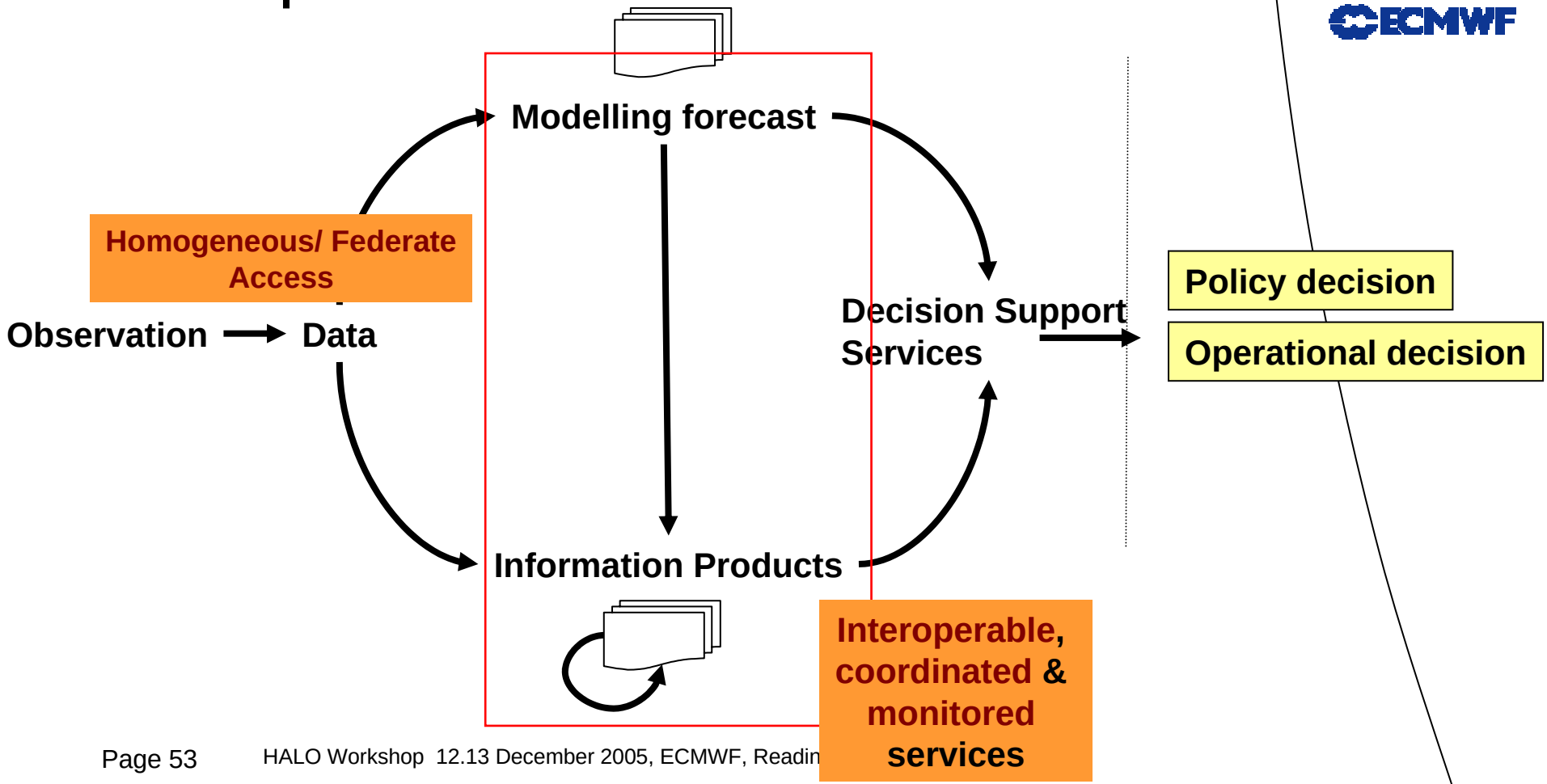
Which reusable relevant components or concepts (WIN, …) **?**

IONIC

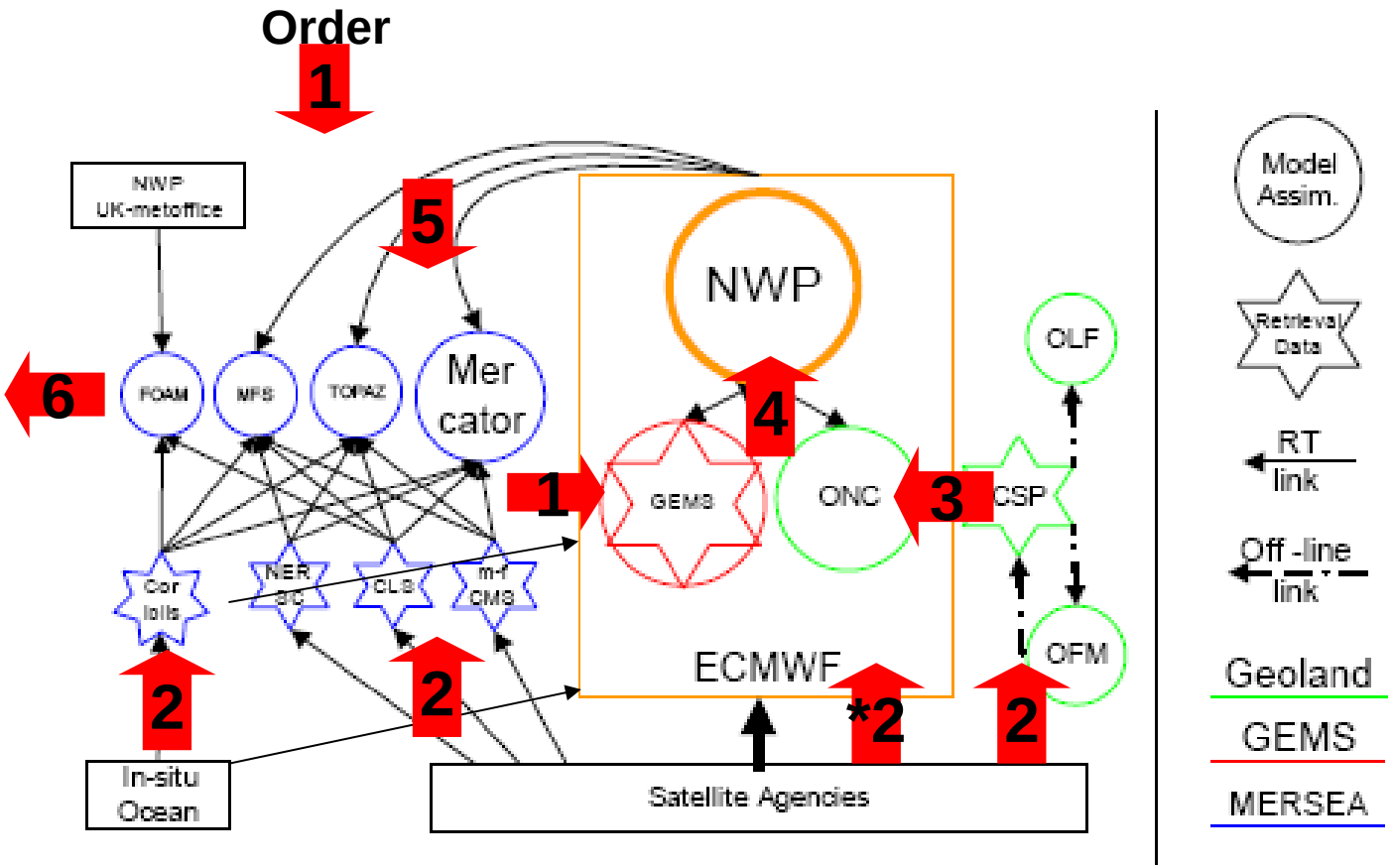




If services are not provided in an efficient manner this is not operational services but scientific issues. What do we need to ensure efficient service provision ?



HALO wants to support the transition of the IPs to operational system status. Operational commitment imposes time constrains of the data production, transfer and storage= Interoperable, coordinated and monitored services



HALO DATA FLOW ANALYSIS (2/3)

M1/ A5
Data flow: Meteo forcing fields
Criteria: regular, RT analysis
Final product: Meteo forecast/ NWP bulletin

M2/ A3
Data flow: GEMS global Aerosol products
Criteria: research mode (TBC)
Final product: Atmo Aerosol data for Atmo corrections in retrieval

M7
Data flow: RT In-Situ
Criteria: RT Flow
Final product: Argo data in RT or NRT, with QC flags

G1/ A6
Data flow: Meteo forcing fields for land surface models
Criteria: regular
Final product: Air temperature/ Humidity, wind speed, precipitation, incoming radiation

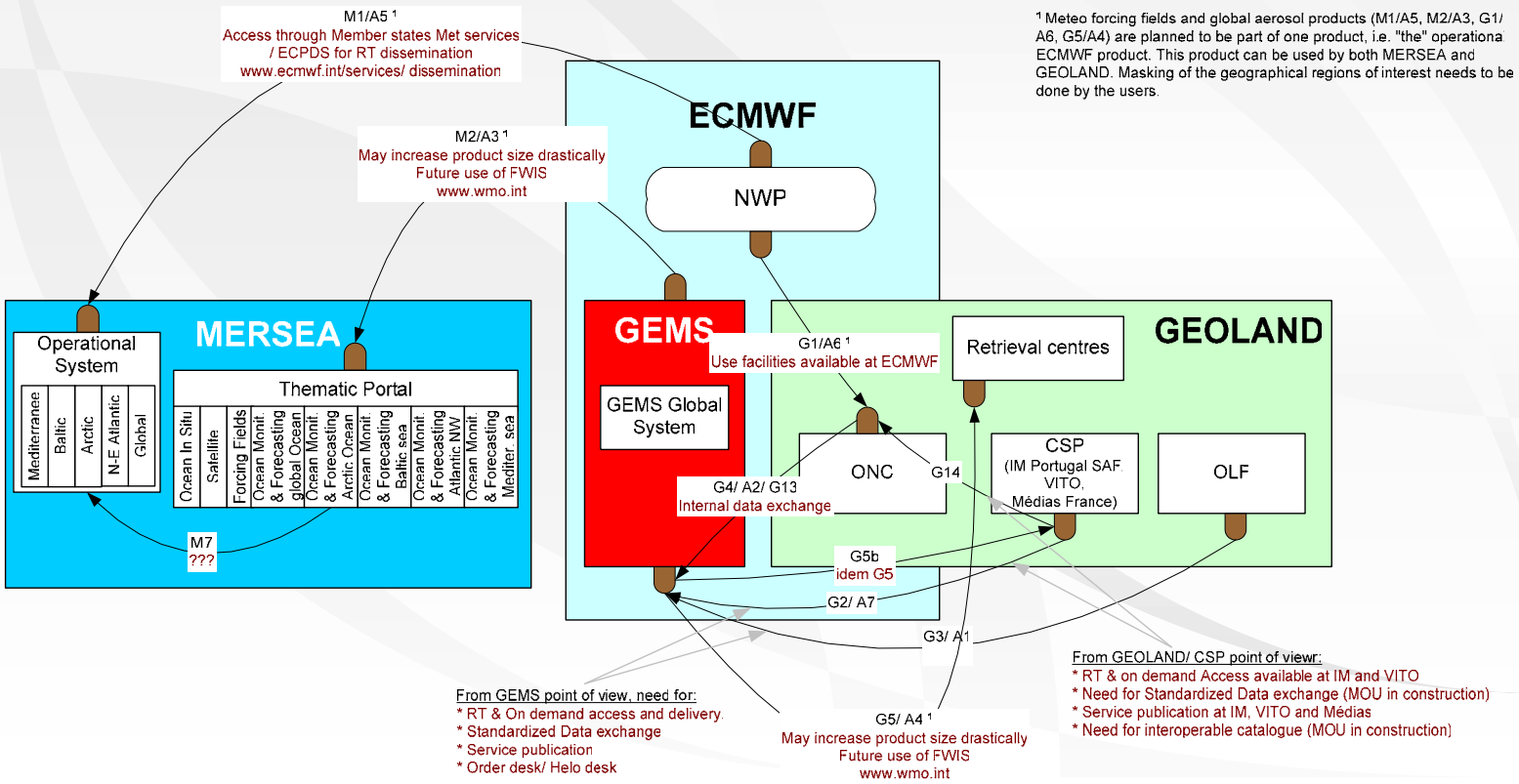
G2/ A7
Data flow: Geoland global products
Criteria: regular + on demand
Final product: Generic Land Cover

G3/ A1
Data flow: Geoland vegetation CO2
Criteria: Research mode (TBC)
Final product: Land use change & forest fires

G4/ A2/ G13
Data flow: Geoland ONC vegetation CO2 & CO2 flux
Criteria: Research mode (TBC)
Final product: Vegetation data as input for emission models

G5/ G5b/ A4
Data flow: GEMS global aerosol products
Criteria: research mode (TBC)
Final product: Atmo Aerosol data for atmo corrections in retrieval

G14
Data flow: Satellite forcing fields for land surface models & LAI
Criteria: regular
Final product: Improved precipitation fields and incoming radiation



[1] Meteo forcing fields and global aerosol products (M1/A5, M2/A3, G1/A6, G5/A4) are planned to be part of one product, i.e. "the" operational ECMWF product. This product can be used by both MERSEA and GEOLAND. Masking of the geographical regions of interest needs to be done by the users.

Service ID: *ECMWF receives: geoland CSP/OLF generic land covers, vegetation CO2, land use change,* *and forest fires*						
Functional element		**Relevance of element**	**Status Quo**	**Compliance**	**Upgrades**	**Relevance of standardisation**
Direct product exchange: *Do you have operational capacities to offer or manage the following elements?*		*Indicate if functional element is relevant for your service operations (yes/no)?*	*What is the current status of function in your service (e.g. which infrastructure, SW used today)?*	*Indicate if current performance of element is sufficient for operational service provision; identify gaps/bottlenecks*	*What are potential or already planned upgrades*	*Indicate impact of standards (e.g. interoperability standards, standardises SW-tool); which standards are/would be useful?*
Provisioning & Dissemination	Real time access & delivery	yes	no function	no: These links are new and depend on future product developments of geoland.		
	On demand access & delivery	yes	no function	no		
	Standardized data exchange	yes	no function	no		
	Service publication (catalogue, metadata)	yes	no function	no		
	Interoperable catalogue of products	yes	no function	no		
	User system integration (e.g Order desk)	yes	no function	no		
	User support (e.g. helpdesk)	yes	no function	no		

Service ID : GEOLAND CSP - The assumptions below is that the main service providers for CSP are IM Portugal (present SAF), VITO and Medias-France						
Functional element		**Relevance of element**	**Status Quo**	**Compliance**	**Upgrades**	**Relevance of standardisation**
Direct product exchange: *Do you have operational capacities to offer or manage the following elements?*		*Indicate if functional element is relevant for your service operations (yes/no)?*	*What is the current status of function in your service (e.g. which infrastructure, SW used today)?*	*Indicate if current performance of element is sufficient for operational service provision; identify gaps/bottlenecks*	*What are potential or already planned upgrades*	*Indicate impact of standards (e.g. interoperability standards, standardises SW-tool); which standards are/would be useful?*
	Standardized data exchange	Yes	No		No upgrade foreseen yet. MoU between IM, VITO and Medias in construction	Major impact
	Interoperable catalogue of products	Yes	No interoperable catalogue available		MoU between IM, VITO and Medias in construction	Major impact

HALO DATA FLOW ANALYSIS (3/3)

M3:
Data flow: Satellite data
Criteria: regular
Final product: Along Track, validated

M4:
Data flow: Satellite products
Criteria: regular
Final product: Merged, gridded validated products

M5:
Data flow: In-Situ observations
Criteria: regular + On-demand
Final product: High quality controlled, merged gridded products, climato

M6:
Data flow: In-Situ observations in RT
Criteria: RT Flow
Final product: RT or NRT ARGO data with QC flags

G6:
Data flow: Satellite data
Criteria: regular + On-demand
Final product: information about lanc surface (vegetation, radiation, water)

G7:
Data flow: In-Situ data
Criteria: regular + On-demand
Final product: Rainfall

G8/ A13 :
Data flow: In-Situ data
Criteria: On-demand
Final product: Validation data for vegetation, radiation, soil moisture & GEMS (GHG, GRG, AER, RAQ)

G9:
Data flow: Satellite data
Criteria: On-demand
Final product: Validation data for vegetation & Land cover

G10:
Data flow: Satellite data
Criteria: Regular + On-demand
Final product: land surface & vegetation status

G11/ A12:
Data flow: In-Situ data
Criteria: On-demand
Final product: CO2 & water fluxes

G12:
Data flow: In-Situ data
Criteria: On-demand
Final product: Radiative surface fluxes

A8:
Data flow: Satellite data
Criteria: Operational
Final product: atmo species concentration & Fire burnt area

A9:
Data flow: In-Situ data
Criteria: Regular
Final product: for validation

A10:
Data flow: CO2 concentration
Criteria: On demand
Final product: validation for CO2 assimilation

** List of Research Labs responsible for accessing anc using the data for validatior of GEMS products:
Ciais, Heimann, NUIG(CEA-IPSL-LSCE, MPI-M), NKUA FMI, DWD, SA, LA, BIRA, Meteo-FR, KNMI/ U.Bremen, CNRS-LOA, RMIB, SA_UPMC, met.no